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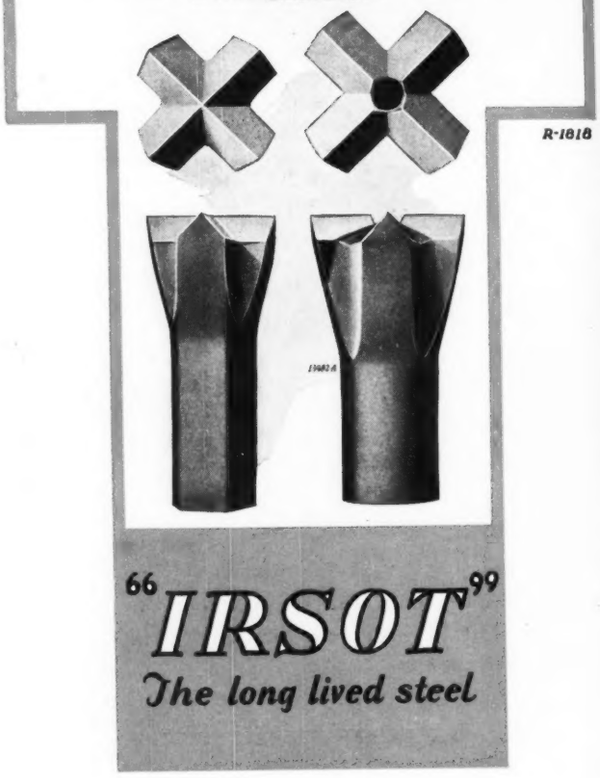

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Number 19

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New York, May 11, 1929

Features of E.&M.J.: VII—Personal Notes

JUDGING by comments made by many readers, no page is more regularly scanned every week, as the *E.&M.J.* is received, than that devoted to personal notes. A mining engineer's friends are scattered all over the world. Personal communication with all of them is impracticable, but their promotions and moves from place to place are topics of social and often of business interest as well. The personal page is the great clearing house for these items, and offers an opportunity for every reader to transmit appropriate news about himself to his friends. When a change in address is requested, a note to the editors about the new appointment would be greatly appreciated, and be of personal and professional interest.

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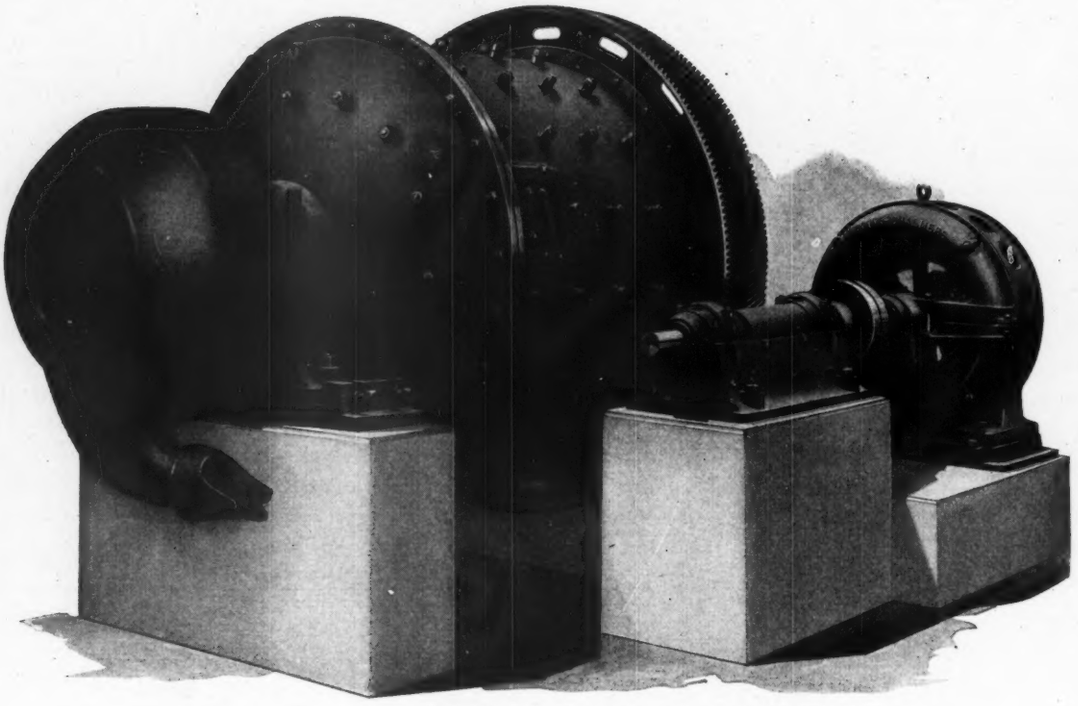

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Source of Supply Now Determines Refinery Site

WHEN Tennyson wrote, "The old order changeth, yielding place to new," he made a statement that can be applied even to the location of electrolytic copper and zinc plants, although that was probably not his intention at the time. In former days, when a company decided to build such a unit, the site was usually near the market, or, in other words, near manufacturing plants that used the metal produced. As a result, the Atlantic seaboard had a virtual monopoly on the business of copper refining. Abroad this practice was prevalent to an even greater extent. Belgium and Germany are important metallurgical centers, but unimportant metal-mining countries. In the case of zinc plants in this country the situation was not quite so distinct; the zinc-retort plants had an important byproduct in the form of sulphuric acid to sell in addition to the zinc. Consequently most of these plants were built in the Mid-West, near the center of the chemical industries, rather than in the East, where the brass manufacturers are located.

Within the last year, however, six companies have decided to construct new electrolytic plants for the production of copper or zinc in the United States and Canada, and, with one exception, each proposes to build at or near the source of supply, rather than near the market. The exception is Evans-Wallower Lead, which is building an electrolytic zinc plant at East St. Louis, Ill., for the treatment of ores and concentrates from Western mines. However, this plant may draw on the comparatively near-by Tri-State field for some of its supply.

At El Paso, Texas, Phelps Dodge, Calumet & Arizona, and Nichols Copper jointly have a refinery under construction that will treat blister copper from the Arizona smelters of the first two companies. International Nickel, American Metal, and Consolidated Mining & Smelting have formed a new company, known as Ontario Refining, which has already started work near Sudbury on a copper refinery that will be ready at about the same time the Frood mine will start production. Although a site has not yet been determined, Noranda Mines has decided to construct another copper refinery in Quebec, near its Horne mine, in conjunction with Nichols Copper and British Metal. Last October Hudson Bay Mining & Smelting stated that an electrolytic zinc plant would be built at its Flin Flon mine, in northern Manitoba, in addition to the copper smelter already planned. Work will be started as soon as power is available from the new Island Falls plant. And now, as the most recent of these projects, Pend Oreille Lead & Zinc proposes the construction of an electrolytic zinc plant at Metaline Falls, Washington, the fifth such plant within a comparatively small area in the Pacific Northwest. And only sixty years ago it was the usual thing for a mine in Arizona, California, or Oregon to ship its ore to Swansea, Wales, for smelting!

This tendency to build at the source of ore and power supply rather than near the market has resulted from the widespread development of cheap power, rapid transportation, and lower construction costs. It is a tendency not restricted to the metallurgical industries either, and it may well mark the beginning of a movement out of the large city and back to the small town. Thus it will add humanitarian advantages to its undoubted economic benefits by relieving the congestion that now marks metropolitan life.

Research Turns Liabilities Into Assets

THE CHEAP AND EFFICIENT treatment of low-grade gold and silver ore has been possible only on clean or comparatively clean material. Interfering elements in the application of the cyanide process are legion, using the word "element" in its broadest sense, to include metallic as well as vegetal cyanicides and many derivative acids. Virtually all the copper minerals are soluble in the ordinary working solution, this constituting an objection to the application of the process that has been experienced in almost every mining country in the world. At times, soluble copper ores have been encountered at depth, necessitating the abandonment of cyaniding operations. In other instances, a comparatively high copper content has not interfered seriously with the application of the process for the recovery of gold and silver. The presence of copper has been found to exert a more baneful influence on the extraction of silver than on the extraction of gold.

An early recommendation involved the pre-treatment of copper-bearing gold ore with acid, but rarely was the step found to be practicable from the economic standpoint, owing generally to the presence of gangue minerals that reacted with the acid. And the neutralization of the ore prior to cyanide treatment was expensive. Research has been applied to this problem from many angles, and sundry processes have been proposed, some of which have been put into successful operation, whereby the consumption of cyanide involved in dissolving copper is counterbalanced by the effect of a cyanide recovery process, thereby keeping the valuable solvent within the cycle. Only in recent months, with the appreciation in the price of copper, has attention been paid

to the possibility of return from a clean-up of copper as well as of gold. This goal is within sight. The prospect of a joint recovery of gold and copper by means of a cyanide solvent brightens as copper prices become stabilized at a satisfactory level.

Excellent work is being done at the Rare and Precious Metals Experiment Station of the U. S. Bureau of Mines at Reno, Nevada, by Messrs. E. S. Leaver and J. A. Woolf, whose article in *Engineering and Mining Journal* of Sept. 22, 1928, on "Re-treatment of Comstock Tailing," attracted considerable attention. Valuable data in preparation include a record of tests to determine the action of cyanide on ores containing copper in amount making them susceptible to the sulphide-acid process developed. The appearance of a technical paper on this subject is being awaited with interest, and the Bureau is to be congratulated on having initiated and carried through a research in the domain of cyanidation that will prove of distinct value to the gold-mining industry.

Bunker Hill Smelter to Add New Equipment

RECENT ANNOUNCEMENT by Mr. Frank M. Smith, of the Bunker Hill & Sullivan Mining & Concentrating Company, to the effect that the Idaho smelter is to extend its plant and make necessary preparations to treat the company's entire product, is of more than passing interest, for it marks the near termination of an ore contract of long standing that has been the subject of legal controversy. This contract expires on Feb. 1, 1930. The original contract was made March 20, 1905, under somewhat peculiar circumstances. It was executed between the Bunker Hill company and the Tacoma Smelting Company, the former agreeing for twenty-five years to ship all its ore that contained between 30 and 75 per cent lead to the smelter at Tacoma, all of the products of mine and mill without the specified limits being open to purchase by the Tacoma smelter on payment of the best prevailing rates. In addition, provision was made that the products specified should be subject to competitive rates after the first five years. Following the ratification of this contract—the day after, in fact—the American Smelters Securities Company acquired all the stock of the Tacoma Smelting Company, which, in June, 1917, assigned the ore contract to the American Smelting & Refining Company. In 1905, the American Smelters Securities Company bought not only the Tacoma smelter, but also the Selby plant, near San Francisco. In 1903, the American Smelting & Refining Company bought the Everett smelter, in Washington, transferring it to the Smelter Securities company. In 1912, the Tacoma plant ceased to treat lead ores, and was coverted into a copper smelter.

The narrowing of the control of lead-smelting plants in the hands of one company was obvious, and the Bunker Hill company entered the smelting business, constructing a modern lead smelter at Kellogg and placing it in operation on July 5, 1917. The American Smelting & Refining Company sought to prevent the Bunker Hill company from smelting its own ores and began legal action toward that end. Judge Wolverton of the U. S. District Court at Portland, Ore., on Jan. 14, 1918, ruled that until the trial of the case on its merits, the Bunker Hill company should ship all its product containing more than 30 per cent and less than 75 per cent lead to the American Smelting & Refining Company, but that products outside of these limits were not involved. Later, in 1918, the two contending companies reached an agreement out of court. As a result, the American Smelting & Refining Company received a substantial portion of the product of the Bunker Hill company. In the meantime, the Bunker Hill smelter prospered, and it is now a highly important factor in the mining prosperity of the Northwest.

The Water Tank Offers the Artist an Opportunity

TWENTY YEARS AGO a certain professor in one of the larger technical schools was fond of reiterating to his students the pithy sentence, "Whatever is good enough in engineering is best." To make anything too good, he held, was to make it unnecessarily expensive—a statement that went unchallenged in the absence of definition as to when a thing was good enough. Be the maxim right or wrong, many a plant, now nondescript or even painful to the eyes, might have been made more attractive had more attention been given to the design of its exterior.

A prominent feature of the average industrial landscape where the terrain is flat or gently rolling is the water tank. The prevailing mode in plant design, if not the actual requirement of the topography, apparently calls for such a tank supported somewhere in the sky on towering stilt-like legs. Not only individual plants but small towns and villages are frequently thus distinguished and are recognized from afar by the particular shape or dimensions of their tanks. By their tanks ye may often know them. A most peculiar sight this device for storing water under head sufficient for local purposes would seem, were it not so commonplace. Serviceable indeed, and no doubt often indispensable, but ugly just the same and calling for improvement. Instead of pride on beholding the skyline of his plant or community defaced by such a blot, the person responsible for the design should feel a keen regret and seek a remedy.

Whether it mitigates or increases the offense is hard to say, but already in several instances some artful person has converted the water tank into something new and strange, primarily perhaps for advertising purposes but possibly with a view to removing the curse of ugliness. A great pineapple made of steel, even to the leaves sprouting from its top, serves as tank for a pineapple company in Honolulu. A lamp company in the East stores its water in a huge bulb of painted metal, supported socket upward. Similarly, a milk company elsewhere uses a tank shaped like a bottle. In Oklahoma a boy-scout camp gets its water supply from a scepter-like structure consisting of a spherical tank mounted on the top of a cylindrical tower which flares outward at each end. A lookout platform surmounts the ball. Observers in other localities might report similar oddities, no doubt.

Indeed, if there must be water tanks, towering monument-like in the air, opportunity is thereby offered to each plant and village to express its individuality

in an artistic as well as a utilitarian manner. Gigantic statues, like Bertholdi's "Liberty," may yet dot our fields and prairies. Development of this new art would, moreover, offer a new outlet for sheet steel and other metals. Thus an attempt to make artistic that which has been strictly utilitarian may also have its practical aspect.

Professional Obligation Should Prompt Spirit of Reciprocity

THE SECRETARY of a prominent overseas mining company, in response to a request for information on recent technical activities, refuses to co-operate on the ground that the publicity proposed is neither sought nor desired. Such an attitude, be it noted, is usually characteristic of mining organizations that are dominated by non-technical, non-engineering boards of directors, none of whom appears to realize the obligation that is commonly accepted among technical workers, whatever their nationalities—to give as well as to receive valuable information. The code of ethics of the directorate of such a company, if it possesses one, makes no mention of co-operation, of fair exchange, much less of generosity in contributing to the progress of the industry as a whole.

Where such a narrow and selfish philosophy is in evidence, one expects to find, and one invariably does find, technical conservatism and lack of engineering initiative, despite the fact that greedy advantage is usually taken of the generosity of others. Knowing the professional hospitality of technicians and engineers in less secretive organizations, its representatives make frequent visits of inspection to modern plants to obtain the latest in ideas and results, all of which is usually given freely. The technical press is likewise combed for helpful information, to aid in formulating the most efficient mining and metallurgical methods, to insure operation at the lowest cost.

Who shall affirm what motives influence an engineer to give to the world the results of his dearly earned experience? Dr. James Douglas once admitted that the impulse probably originates in a desire for reciprocity —"in the hope that others will tell what they know, in return for what we ourselves communicate, and that therefore we shall learn as much as we can teach." This implies a spirit of brotherhood, a sense of fair play, and a recognition of obligation—qualities that are conspicuous by their absence among many directorates of the type mentioned, whose narrowness of viewpoint works a hardship on a technical staff, engaged to further the interests of the company, but forced to be inarticulate by the stupid and selfish policy of its "superiors." Many directors have yet to learn, moreover, that a definite and sustained policy of secrecy in regard to technical progress indicates poor business acumen.

An editor's dream of heaven would certainly include opportunity to remind such selfish members of his constituency of their refusal to contribute to the melting pot of knowledge, by declining to continue to supply them with the means of securing, at a negligible cost, a continuous record of the labors, researches, experiences, and conclusions of their more generous brethren.

Extension of Geological Surveys in Nevada Is Promised

THE NEVADA LEGISLATURE has voted to co-operate with the United States Geological Survey to the extent of $10,000, which it is believed the government will match with a similar amount. In addition, a state Bureau of Mines with an appropriation of $5,000 has been authorized. Both sums are for the biennium. Nevada has for several years maintained a laboratory for analyzing ores and minerals found by prospectors.

The Geological Survey has published numerous bulletins and monographs about the mining districts of Nevada. One of the most notable was Mr. J. E. Spurr's monograph on the Tonopah district. King's Fortieth Parallel Survey gave information about the general geology of an east-west area across Nevada. Later, Spurr made a reconnaissance and published a bulletin about the region south of the Fortieth Parallel. Becker's monograph on the Comstock was a notable contribution to geological literature at the time, and Gilbert's monograph on Lake Lahonton detailed recent geological changes.

There is thus a basis for the extension of geological knowledge about Nevada. A good beginning has been made, and the immediate prospect of additional work is of great interest to Nevada miners. Co-operation of the state with the Geological Survey will bring about the best plan for an effective spending of the funds provided by the people of Nevada.

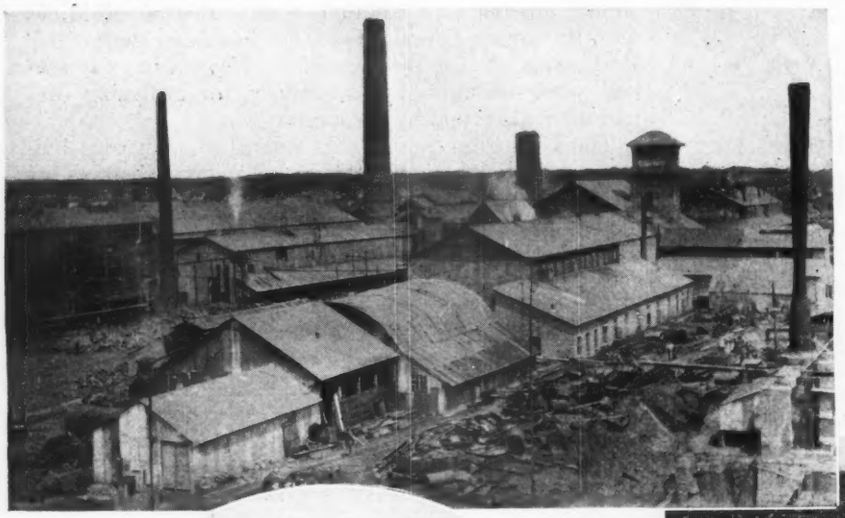
Illustrating the Breadth of the Mining Industry

UNDER the caption "Big Business Goes Collegiate," F. P. A., in the New York *World*, reprints an advertisement from the New York *Times*, reading as follows:

"AMATEUR BASEBALL PITCHER WANTED—Large mining interest located in Eastern Canada offers an opportunity to a young man; applicant will be placed in engineering, clerical, or other work suitable to his training; give education and baseball reference. Z 2023 Times Annex."

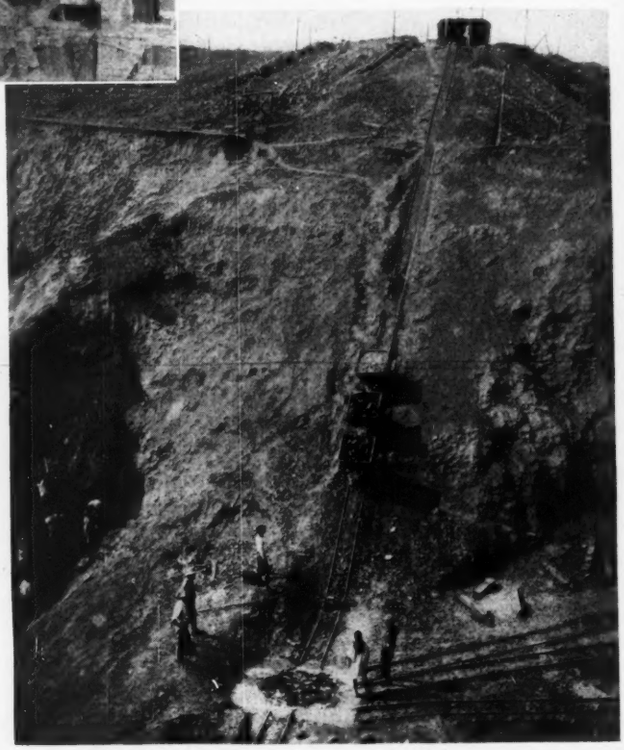
Graduate mining engineers are not the only class of youngsters that the mining companies are looking for in the spring. In fact, a good pitcher may easily assume considerably more temporary importance in a mining camp than an equally good young mining engineer. In out-of-the-way places such as mining camps, where professional sports do not penetrate except through the medium of the daily paper, the employees must provide their own outdoor recreation. Baseball is popular, and small inter-company or intra-company leagues are by no means uncommon. No one cares a great deal about one team of dubs beating another, so it is usual to secure outside talent, especially for the pitcher's box. Hence the advertisement reprinted above. Usually there is a league rule against professional players, or paid performers, so it is up to the company to find a suitable job, and we suspect that the company mentioned is going to find itself with at least one extremely well-paid scale clerk or time-checker this summer.

METAL MINING *in the Heart of Africa*

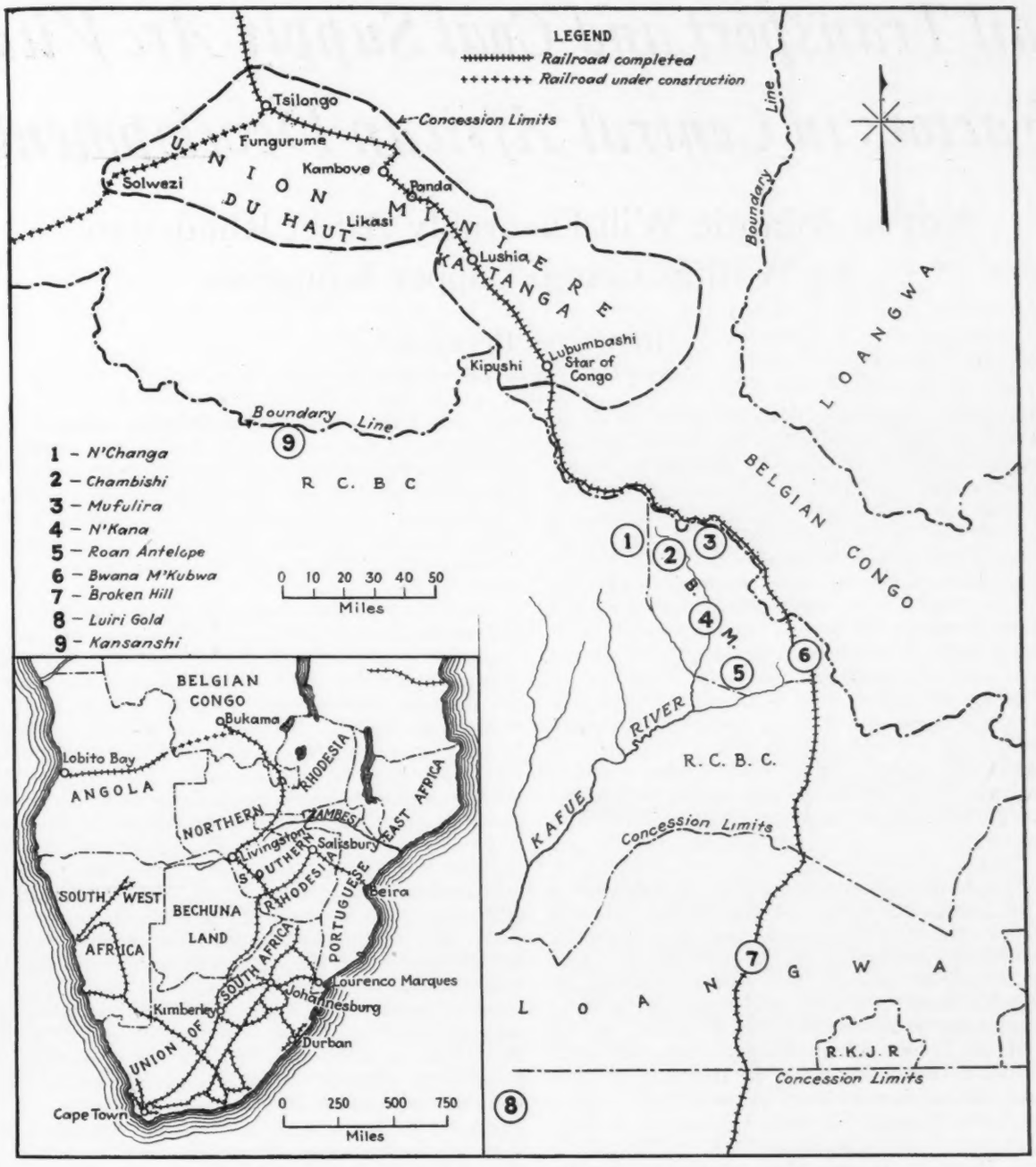


At the left—The Lubumbashi smelter of Union Minière, which has been in operation since July, 1911, and is the oldest metallurgical plant in the Congo region

Below — Hauling up lead ore at the Rhodesia Broken Hill property, the only important lead-zinc mine yet found in central Africa



In the oval—The open cut mine of Union Minière at Kambove, which supplies much of the ore for the Panda works



A map of the Congo-Rhodesia region, where developments indicate the growth of a copper-mining region equal in importance to the American Southwest

At the left—A panorama of the Panda plant of Union Minière, showing the concentrator and smelter. A leaching plant is now under construction.

Rail Transport and Coal Supply Are Vital Factors in Central African Development

Exit to Atlantic Will Favorably Affect Rhodesian As Well as Congo Copper Industries

By Owen Letcher
Special Correspondent, Johannesburg

THE great mineral field lying on either side of the Congo-Zambesi watershed in the southern part of central Africa is undoubtedly destined to become the industrial hub of Africa, and, as such, the railway policies that will be determined by its development and that are, in fact, being determined today, must exert influences of tremendous importance on a vast portion of the African continent. Main connection with the seaboard at present is by means of the railway which crosses northwestern Rhodesia from the Congo border to Victoria Falls. This line passes through Wankie and Bulawayo, meanders through Southern Rhodesia via Salisbury and through Umtali to Beira, in Portuguese territory, on the Indian Ocean. It continues northward to Elisabethville and on to Panda, where the concentration and smelter plants of the Union Minière are situated, and where the first unit of that company's leaching plant of 30,000 tons per annum capacity is being constructed.

From Panda the railway then proceeds to Tshilongo—where the Lobito Bay railway at the close of 1930 will link up with the Belgium system—and on to Bukama, on the navigable waters of the Upper Congo. From Bukama the line continues to Ilebo or Port Francqui, on the navigable Kasai, and from this river port there is a rail-and-water route to Matadi and Boma, at the mouth of the Congo. From Bukama, Dar-es-Salaam, on the Indian Ocean, is reached by means of another rail, river, and lake route via Albertville and Kigoma Bay, on Lake Tanganyika, along the Central railway line to the capital of that mandatory state on the eastern seaboard. These are the three routes available at present, and the Union Minière has shipped copper over each of them. But the lower Congo route, like the Tanganyika line of communication, involves transshipments from rail to river and from river back to rail before the metal can be placed on ocean-going steamers at Matadi.

Transshipment consumes much time and is costly. It is proposed eventually to link up Ilebo direct with the lower Congo at Matadi, but, before this undertaking is completed, the Benguella railway will be connected with the Belgian systems. To what extent Belgian enterprises will utilize the Lobito Bay line in preference to their own National Bas Congo route, the Rhodesian railways to Beira, and in lesser degree the trans-Tanganyika route, remains to be seen. Lobito Bay, by virtue of its geographical position in regard both to the copper fields and the world's largest markets, and also because of its magnificent harbor, is the natural gateway to south-central Africa. The Benguella railway and Lobito Bay will undoubtedly obtain a large proportion of the trade of the Congo, and, in years to come probably much of that of Northern Rhodesia. Yet it must be realized that the whole railway problem in this part of the world is complicated by several factors. First and most important of these is the geographical and economical relationship which the Wankie colliery bears to the metal mines.

The Wankie coal field lies 212 miles north of Bulawayo, 564 miles south of N'Dola—the junction for the Northern Rhodesian copper belt with the main railway system—and 823 miles south of Panda, in the heart of the Katanga mineral belt. It is one of the most extensive coal fields in the world, and the area controlled by the Wankie company is estimated to contain not less than 3,000,000,000 tons of coal. Besides possessing good steaming qualities, the coal also produces a high-grade coke. It was Wankie coke that solved the metallurgical problems of the Union Minière in the early days; it was Wankie coke that enabled the Congo to commence copper production in 1912 and that has enabled the company to continue producing copper ever since; and it has been Wankie coal that has supplied the locomotives of the Rhodesian and Congo railways which haul goods and supplies of all kinds from the coast and millions of pounds' worth of copper from the mines. When you travel over the Rhodesian lines and the C.F.K. in the Congo, you will see at stations and sidings long trains of coal and coke bound for the north, and empties, labelled Charbonnage, awaiting return to Wankie. Fortunate it is, both for the Rhodesian railways and for the copper mines, that there are at Wankie these millions of tons of good coking coal. It is also fortunate for Wankie and for the Rhodesian railways that in this vast country between the Limpopo and the Nile no other coal fields producing coal and coke of competitive value have so far been discovered.

At the Sankishia and Luena coal fields, in the Congo, the Belgians long ago opened collieries; but the qualities of the fuel leave much to be desired, and, although a certain amount of Sankishia coal is used in pulverized form at the Panda plant, the results are not sufficiently satisfactory to enable the Congo mining and railway companies to contemplate complete independence of the Wankie fields. The Belgians have, however, planned several large hydro-electric projects and one of these, on the Lufira, is in operation. They are also erecting the first unit of a large leaching plant at Panda; this first unit will be of 30,000 tons' capacity per annum. Two other units of similar capacity are to be constructed. Erection of another large leaching plant to serve the

western or Monsonoi group of mines is under consideration. By these means the Union Minière may eventually secure a certain measure of economic independence of Wankie, but the entire project will have to be considered carefully in relation to capital as well as to operating costs. It would seem that the more southern mines of the Katanga—that is, those in the vicinity of Elisabethville, such as Ruashi and Kipushi—will continue to depend largely on the Rhodesian railways and to draw on Wankie for coal and coke supplies. But there can be no question that the policy of the Belgians, for both political and economic reasons, is gradually to secure emancipation from the influences of the south and to market their metals and import their supplies via the Atlantic seaboard. Another interesting possibility to be borne in mind is the importation of coke from Europe. The Benguella railway will take huge tonnages of copper seaward, and it is probable that there will not be a corresponding volume of inland traffic. The possibility, therefore, of cars, which otherwise would return empty, coming in from Lobito loaded up with coke from Antwerp, which has borne only the comparatively cheap ocean transport, must be considered.

In Northern Rhodesia is a coal field which as yet is much of an unknown quantity, and particularly so with regard to the coking properties of the coal. This is the Luano coal field, east of Broken Hill. The coal area in the Luano Valley is owned by the Rhodesia Katanga Junction Railway and Minerals Company, which is a Robert Williams enterprise This company built, and until recently owned, the section of the railway line extending from Broken Hill to Sakania, a station on the Congo border. A few months ago Rhodesian Railways exercised the option which it possessed over this line. R.K.J.R. also owns the Kansanshi copper mine, which was discovered by George Grey on behalf of the Robert Williams expedition in 1899. Kansanshi produced quantities of copper prior to the outbreak of the war, and, after a long period of idleness, the mine was reopened about two years ago. The Robert Williams' interests, represented by the Tanganyika Concessions group, with its controlling interest in the Benguella Railway, its large holding in the Union Minière, the Kansanshi Copper Mine, estates in Angola, and the Luano coal areas, constitute another and an important factor in the industrial and transportation complex of Northern Rhodesia. Sir Robert Williams and his colleagues have always been in favor of a Lobito Bay route, and therefore are against the plans of the Chartered Company-Rhodesia Railway-Edmund Davis interests for an ocean terminal at Beira.

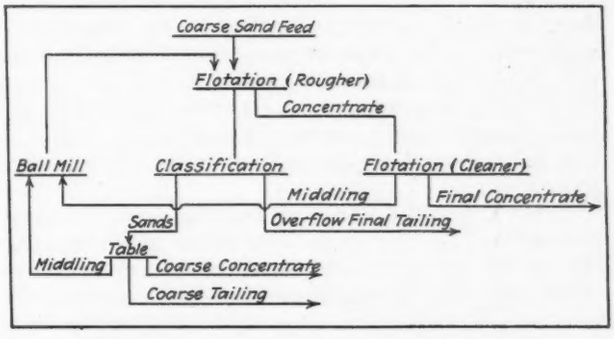
In the course of the endeavor to bring Rhodesia into the Union of South Africa the Benguella railway project received considerable criticism, construction of the line from Lobito Bay being suspended for a time. The object of this was to retain the trade of Katanga for the railways of Rhodesia, which it was proposed the Union should absorb. The Belgians, alarmed at the trend of political events, pushed ahead plans for the construction of the Bas Congo line. All this, however, was quite unnecessary. Rhodesia refused to enter the Union, and money was found for the completion of the Lobito Bay line to the Congo border.

In June of this year Sir Robert Williams will open the Benguella Railway to the Congo border. By the end of 1930 the line should be completed to Tshilongo on the C. F. K. system, and, when this is accomplished, the route will undoubtedly exert a powerful influence not only on the copper trade of the Congo but also on the Northern Rhodesian mines.

Bureau of Mines Develops New Process for Concentrating Coarse Sands

DEVELOPMENT of a concentration process embodying flotation, classification, and tabling, in the order named, has been one of the most important results of a research study on coarse sand flotation conducted at Moscow, Idaho, by the U. S. Bureau of Mines, in cooperation with the University of Idaho, according to a recent announcement of the Bureau. Details of the process, which was developed for the treatment of Michigan amygdaloid copper ores, and which has since been put into practice in the Michigan district, are discussed in Serial No. 2,921, *Reports of Investigations,* U. S. Bureau of Mines, by A. W. Fahrenwald and Clarence Thom. Excerpts from the bulletin, with an explanatory illustration, follow.

The process is particularly applicable to simple ores comprising a single mineral to be recovered which is liberated wholly or to a large degree from the gangue minerals at relatively coarse comminution. In this process, flotation removes all the fine- and intermediate-sized mineral grains. No effort is made to get flotation to make



Flow sheet of coarse sand concentration process

a finished tailing. The flotation tailing is subjected to classification, preferably of the constriction plate density control hydraulic type; however, classification of the Dorr classifier type has usually been found to give good results.

The classifier overflow is final tailing. Classifier sand, which contains the coarse mineral grains too large and heavy to float and the true middling grains, is tabled. Table products are coarse mineral, middling, and a coarse tailing. The coarse mineral generally is cleaned on a second table, and the middling is ground and returned to the initial flotation machine. Feed desired for this process is coarser than is common in present "all flotation" practice, and is about the size of table feed. The flow sheet above presented shows the details of the process.

The process is simple. It avoids complex flow sheets and dilution problems inherent in present combination classification, gravity, and flotation flow sheets. Feed is prepared by crushing in closed circuit with classification. The coarsest mineral grains in the classified product are finer than the coarsest lighter rock grains. Previous practice in Michigan which the new process is now displacing produced concentrate assaying about 35 per cent copper and a final tailing assaying 0.22 to 0.35 per cent copper. The new process makes 50 to 65 per cent copper concentrate and gives a final tailing considerably lower in grade than that which was generally obtained under previous practice.

Arizona Copper Prospects

Summarizing the More Important Ore Occurrences in the State—A Long-Lived Production Indicated

By J. B. TENNEY
Geologist, Arizona Bureau of Mines, Tucson, Ariz.

THE State of Arizona is now producing nearly a quarter of the copper consumed by the world. The greater part of this production is coming from the so-called porphyry deposits of Inspiration, Miami, Ray, Morenci, and Ajo. These deposits, thanks to the application of the most advanced metallurgical practice, and to the best of managing skill, are now mining and beneficiating ores which even ten years ago would have been thought hardly worthy of stockpiling. This has had the result of greatly increasing the lives of these properties.

Arizona should continue to lead the world in copper production for the next generation at least from the output of the mines now producing, regardless of the price of copper. When these mines are exhausted what is the outlook in the state? What undeveloped prospects are left to take their places? An attempt is to be made to answer these questions. The possibilities in the existing producing districts will be first stressed, as these will probably be the first to be developed, as existing reduction plants and organizations can be utilized. In succeeding paragraphs the prospects in the more remote districts, which will necessitate pioneer work and the expenditures of greater capital to develop them, will be described. In the final paragraphs descriptions will be given of the prospects having possibilities for relatively smaller tonnages and higher grade, which in the aggregate may considerably swell the output. The figures in parenthesis after the district names refer to locations on the accompanying map.

Globe-Miami District(1)—In this district, the home of the Inspiration and Miami mines, the holdings of the companies operating them probably include all the immediate possibilities for large tonnages of ore of a grade better than 1¼ per cent copper. There is, however, an area, approaching in extent the combined holdings of the two large companies, which the few scant holes already drilled indicate to be underlain by an enormous tonnage of material between the grades of 0.3 and 1½ per cent copper. This great tonnage of low-grade material, on the exhaustion of the present reserves, will most probably be developed and mined at a profit. The occurrence is geologically similar, except in grade, to the ores now being mined.

There is also another large area in the district, the possibilities for which are more problematical, an area probably underlain at great depth by porphyry copper deposits, covered by an unknown thickness of Quaternary Gila conglomerate. It is quite probable that future advances in the technique of geophysical prospecting will disclose their existence and location.

Bisbee-Warren District(2)—Here, the possibilities for the expansion of the porphyry ore are remote. Large areas of mineralized porphyry are partly developed by advance holes, but the grade was found so extremely low that it is doubtful if any substantial new finds of commercial ore of this type will ever be developed. The greatest possibilities in the camp are for new finds of the limestone replacement type of ore, from which the major output has come. Mineralization is known to extend for several miles east and southeast of the developed ground. If this area is underlain by commercial orebodies, they will probably be found at considerably greater depths than those already located. The grade and magnitude of the primary orebody now being developed, lying the farthest to the east, has greatly stimulated interest in this ground and has made its development more certain of success. Here again geophysical prospecting may aid in the solution of the problem.

Morenci District(3)—In this district, the possibility of the development of enormous reserves of low-grade disseminated ores is bright. The preliminary work is now under way. Morenci was one of the first copper camps to be exploited in the state, and indications point to a very long life at an increasing production rate.

Ray District(4)—The orebody in this camp has long been blocked out. The reserves of commercial ore depend on metallurgical advances, but as the minimum grade possible to treat at a profit continues to decline, the life of profitable operations is likely to be long. There are no other known areas in the district likely to be underlain by large bodies of ore, such as occur in the Globe district.

Ajo District(5)—Around Ajo, first exploited for copper in the late '50s, the unique feature is that the bulk of the reserves of disseminated ore are primary. The oxidized ores first treated, by leaching and electrolytic precipitation of the copper, are underlain by disseminated bornite and chalcopyrite, with only a very thin skin of enriched ore between the two. The ore occurs in a fractured and metamorphosed monzonite mass. This mass is covered to the south by an unknown thickness of agglomerate. The possibilities of orebodies similar to that now being exploited, in the extension of the monzonite under this covering are now being tested.

Jerome District(6)—No disseminated ore has been

found in this district. The occurrence here is as vertical pipes, in Pre-Cambrian schist, of more or less massive pyrite within which are lenses of high-grade copper sulphides. The possibilities in the area of schist exposures have been nearly exhausted. The schist to the northeast and southwest is covered by later sediments and extrusive flows of basalt. One bonanza orebody has been found to the northeast under this covering, so large sums have been spent prospecting this area for others, but so far without success. One lens of ore has been found near the borders of the covered area to the southwest. In both areas, prospecting is necessarily blind, so unless geophysical appliances can be of aid, ore finds will be fortuitous.

The United Verde orebody continues to hold out without change to the depths prospected, thus assuring an indefinitely long life to the camp even if no new ore is found.

Superior District[7]—The success of the Magma Copper Company in the development of a large body of high-grade ore in the Magma or Silver Queen vein under a surface cropping of comparative insignificance has stimulated the extensive search for others. The Magma vein and other veins of the district are covered to the east by an unknown thickness of extrusive dacite. There are possibilities of hidden orebodies beneath this covering. Diamond drilling is now being done in an attempt to solve the problem of the thickness of the dacite and the geological conditions beneath it.

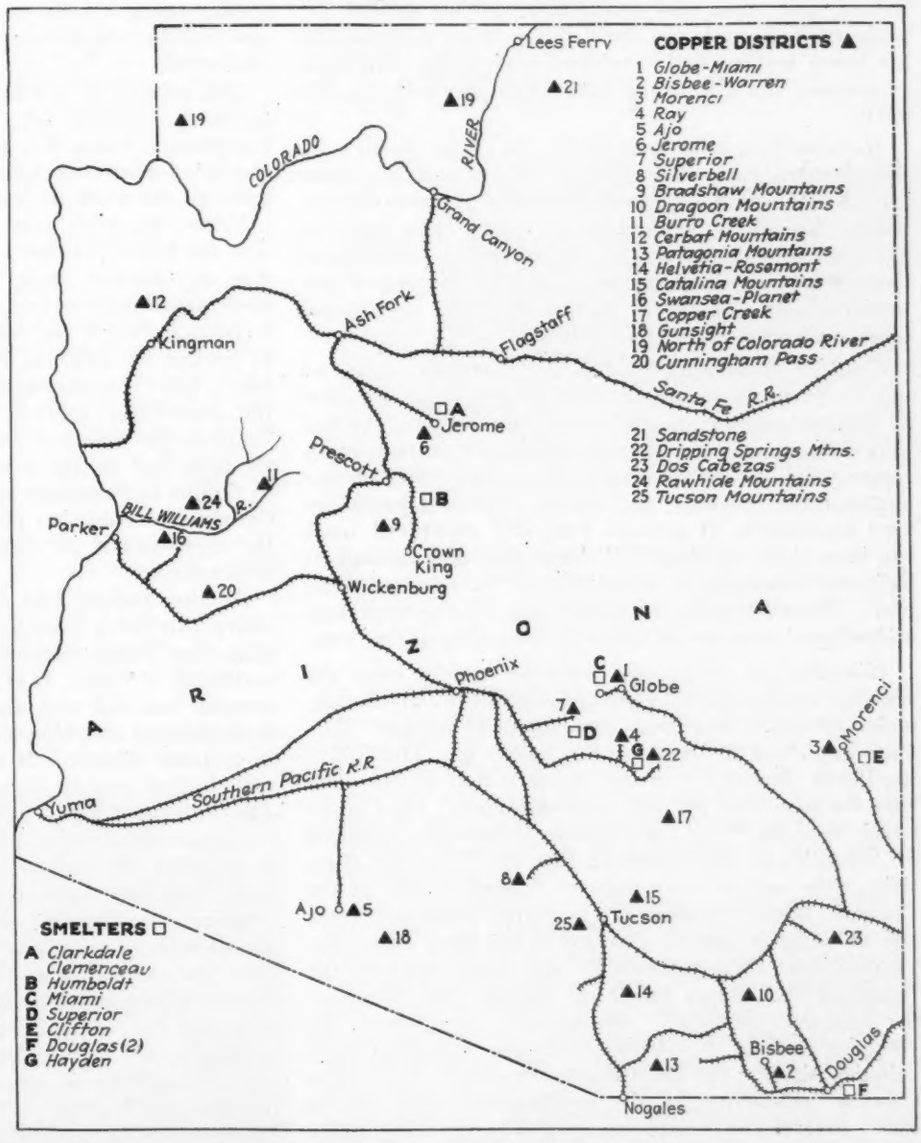
Silverbell District[8]—The copper deposits in this district, 35 miles northwest of Tucson, were early known and worked. The first ore mined occurred as rich irregular limestone replacement near the contact with a large intrusive mass of metamorphosed p o r p h y ry. On the exhaustion of the richer replacement ores, prospecting was done in the porphyry. Substantial reserves have been blocked out, the richer parts of which are now being mined. The ore is not of high grade, but well within the limits now mined and treated elsewhere in the state.

Bradshaw Mountains[9]—On the eastern slopes of this range is a long exposure of Pre-Cambrian schist extensively intruded by granite. In this belt occur a number of lenses and veins carrying pyritic copper ores, generally of a low copper tenor, several of which have had good production records. A small output is now forthcoming, and at several of the deposits, preparations are under way to mine on a more extensive scale. With selective flotation, the ore is generally amenable to concentration into a high-grade product. The individual deposits are small, but in the aggregate they are unquestionably capable of making a substantial copper production.

Dragoon Mountains[10]—At seven localities in this range of mountains in the southeastern part of the state occur limestone replacement deposits of copper ores. At two of them, the better ore has been mined out, leaving large reserves of very low-grade pyritic material. This material may in the future be treated at a profit. At other localities in the range occur similar deposits in which zinc blende occurs intimately associated with the copper. With the advances made in selective flotation, these deposits eventually will be mined and treated at a profit. A considerable tonnage is known to exist, partly developed.

Burro Creek Deposits[11]—On the western boundary of Yavapai County, near the headwaters of the Bill Williams River, exists a large partly blocked-out deposit

Sketch map of Arizona, showing copper districts referred to by Mr. Tenney, with rail transportation and smelter facilities



of disseminated low-grade copper ore in monzonite. Work is now being done on it, but its inaccessibility has militated against its full development. To bring it to production, a railroad will have to be built through rugged country at considerable expense. The deposit is the largest known porphyry deposit in the state yet to be mined, outside of the producing centers.

Cerbat Mountains[12]—In this range occur several potentially large disseminated deposits in porphyry. From what work has been done on them, the grade is lower than in those now being exploited. On the exhaustion of the disseminated deposits elsewhere, these deposits will probably be developed and brought into production.

Patagonia Mountains[13]—This range has produced a considerable amount of copper from a variety of types of deposits, the largest production having come from a deposit in porphyry. Others of this type exist of generally low copper tenor, which will eventually be exploited. One deposit of medium size is now being developed. It occurs as pipe-like replacements in intensely altered sediments. The ore is low in grade, but readily responds to selective flotation, yielding a high-grade concentrate. The property is being developed and equipped, and should soon come into production. Other smaller deposits of high-grade ore occurring as veins in monzonite are being worked and developed both in the Patagonia Mountains and also in the Santa Rita Mountains to the north.

Helvetia-Rosemont district[14]—In this district, in the northern part of the Santa Rita Mountains, occur a number of relatively small limestone replacement deposits, extensively worked in the past. The best ore has been mined, leaving in the ground a considerable tonnage of low-grade pyritic material, forming a potential reserve for future development and exploitation when economic conditions permit.

Catalina Mountains[15]—On the northeast slopes of this range to the northeast of Tucson a large intrusion of diorite occurs cutting Paleozoic limestones. At and near the contacts occur several deposits of medium-grade copper sulphide ore associated with garnet, other contact metamorphic minerals, and pyrite. These deposits are very inaccessible at present, and only superficial work has been done on them. A large potential tonnage is indicated, amenable to concentration by selective flotation. These deposits constitute one of the important undeveloped reserves of minerals occurring in the state.

Miscellaneous Deposits—Scattered widely over the state are small deposits, generally inacessible, which may, under favorable conditions, be eventually worked. The more important of these are the following: The Swansea-Planet deposits[16] in the western part of the state near the mouth of the Bill Williams River; the Copper Creek deposits[17] in the Galiuro Mountains, southeast of Winkelman; the Gunsight deposits[18] in the Gunsight Hills east of Ajo; several deposits north of the Colorado River,[19] generally replacing limestone, from one of which a notable production has been made; the Cunningham Pass deposits[20] and other veins in the Harcuvar Mountains north of Salome and Wenden; the sandstone deposits[21] southeast of Lee's Ferry; the Dripping Springs Mountains limestone replacement and vein deposits[22]; the Dos Cabezas deposits[23] in the Dos Cabezas Mountains in the southeastern part of the state; several small deposits, generally replacing much metamorphosed limestone in the Rawhide Mountains[24] north of the Bill Williams River; and several low-grade deposits in the Tucson[25] and Silver Bell[8] mountains and other desert ranges.

Large High-Grade Deposits Still Far from Exhaustion

The better-grade and largest deposits are undoubtedly being exploited. These will produce at the present, or at a greater rate, for many years. As they approach exhaustion, enough potential deposits exist to make up the deficiency for an indefinitely long period. It is safe to predict that Arizona will be an important producer of copper as long as the metal is important to industry and civilization.

Radium Ore Fields of South Australia

ORE from which radium may be extracted has been known to exist in South Australia for the past twenty years, but efforts at developments have been spasmodic, owing chiefly to the difficulty in mining the ore and to the expense of treatment, says the Adelaide *Advertiser*.

The total value of radium produced in South Australia is about £11,000. At present the Australian Radium Corporation has a lease of country at Mount Painter, in the far northern portion of the Flinders Range, a few miles to the south of Yudnamutana.

When the work was in progress some years ago it was not found possible to dispose of the ore locally, nor was any attempt made in Australia to treat it for its contents of uranium and radium. High-grade ore, stated to contain over 5 per cent uranium oxide, was exported to Europe for sale, but it was not found possible to obtain a price commensurate with the known contents of the radioactive ingredients, so work was abandoned. Latterly the company mentioned has further developed the field, and erected a treatment plant for the recovery of radium and uranium salts. Transport of the ore from the mine to reduction plant has been difficult, involving the employment of camels for haulage for the first few miles.

Another radium field is situated at Radium Hill, near Olary, this being close to the Broken Hill railway. The lodes here contain titanium as well as radium, and the ore is difficult to treat. It is crushed with sodium carbonate solution in a ball mill, and when ground sufficiently fine is discharged and blown to an overhead tank by means of a steam injector. It is then digested for four hours with boiling sodium carbonate, to extract the uranium. The pulp and liquid are then transferred to settling tanks, whence, after a suitable interval, the clear solution is decanted off, the pulp being again digested with sodium carbonate solution to insure complete extraction. Uranium is afterward obtained as sodium uranate by the addition of caustic soda to the liquor. The residue, after the extraction of the uranium, is well washed to remove alkali, and is then boiled with hydrochloric acid to extract the radium, which is then precipitated from the solution in the form of sulphate. Being afterward converted into bromide salt, the radium bromide is finally obtained in the required degree of purity by repeated fractional crystallizations.

Airplane Provides Safest Method of Prospecting in Virgin Canadian Territory

By JOHN E. HAMMELL
President, Northern Aerial Minerals Exploration, Ltd.

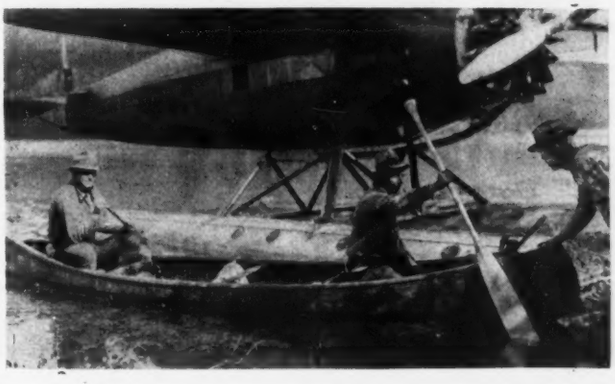
N.A.M.E. airplane at Fort McMurray, Alberta, after a five-hour flight from The Pas, Manitoba

THE MAJOR PORTION *of this article is reprinted from a paper presented at the annual general meeting of the Canadian Institute of Mining and Metallurgy held last March at Winnipeg, Manitoba. Appended to the reprint of the paper here is a summary of operations of Northern Aerial Minerals Exploration that have been performed during the winter months since Mr. Hammell's paper was prepared. This summary is based on information courteously furnished by Gordon G. Duncan, director of exploration, of the N.A.M.E. company.*

ONE HUNDRED THOUSAND MILES of flying over the North Country without a single air casualty; much of it over virgin territory probably never before visited by white men; some of it over regions that abound with possibilities for minerals; all of it effective, for exploration and the establishment of bases and supply stations, and for the carrying of men and their tools and provisions—this, briefly, is the record of Northern Aerial Minerals Exploration, Ltd., a Canadian company organized less than nine months ago, which has been functioning, without interruption, during spring, summer, and winter.

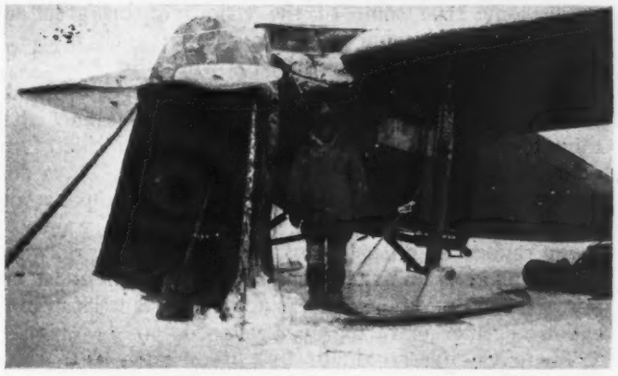
Our airplanes have ranged from the Alaskan boundary on the west to the Labrador coast on the east, and from the Transcontinental railway north to the Arctic Circle.

Prospectors starting out on a reconnaissance trip in a sectional canoe transported by airplane



Our prospectors, carried on trips of hundreds, and occasionally thousands, of miles, have gone over large sections of country which were never before explored, and at the end of the prospecting season the company finds itself in possession of several groups of important gold claims, which look most promising. In addition to this, we have been in contact with deposits of almost every known mineral.

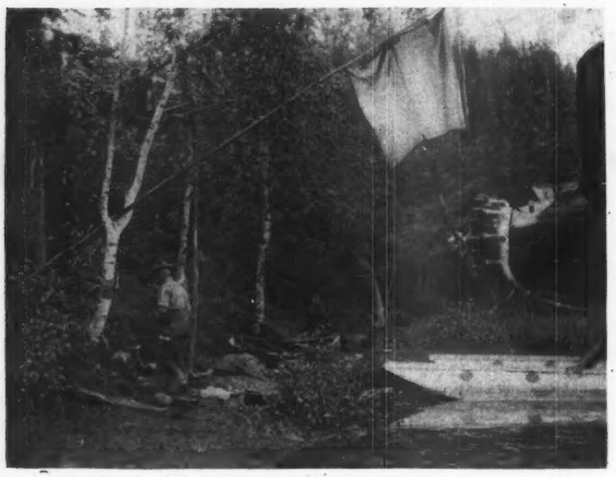
We have, for instance, staked 5 miles of claims on Belcher Island, in Hudson Bay. This, added to the very large area the company had previously secured, gives us one of the greatest iron deposits on the North American continent, or in the world. Though there are problems to overcome, and we are not getting excited over the prospect, Belcher Island in the future may be the means



Pilot T. M. Reid and N.A.M.E. airplane at Great Whale River last January. The motor of the airplane is being warmed under a cover of eiderdown preparatory to taking off

of building large metal centers on the shores of Hudson Bay. One can visualize the possibility of Canada dominating the iron and steel trade of the world by reason of such vast iron storehouses, but, of course, we are now most concerned with the tasks resulting from a highly practical and sound prospecting effort, which embraces sufficient opportunity to keep an army of men employed for many generations.

But it is vision crystallized into practical effort that will hasten the opening of the North. We hold cheaply, perhaps, some of the resources that will count most in our future. We cannot have too many men who are ready to give themselves to the country, and there are many pages in the book of the North over which many men may write their records. My own efforts in the country could not reach a very big goal if the thought of a monetary "clean-up" were the dominating motive. This was not the motive of Vilhjalmur Stefansson when



Supplies arriving at Landing Lake, North West Territory

he endeavored to hasten the time when the North would be a country of large population. He had a splendid vision, but he was never given a chance to carry it out. Through no fault of his, his attempt to domesticate the reindeer was terribly bungled, but I am confident that some day his work will be carried on. One of the things I prize most since the organization of N.A.M.E. is an autographed copy of his latest book, "The Northward Course of Empire," on which he was kind enough to write "To John E. Hammell, a pioneer who has already made come true some of the visions of his great admirer." Undeserving as I may be of such praise, I cannot help but be inspired by his words.

But to get back to earth—or, rather, to get up in the air again—I wish to draw attention to the fact that, though the aviation feature is the spectacular side of the company, N.A.M.E. is not a flying company. It is definitely and supremely a mining exploration company, and uses, as necessity demands, every form of transport, from canoes and dog teams to tractors and railways. The airplane is an arm of the service, and the most important one, becoming increasingly important as organization becomes more highly developed.

There can be no doubt that the future of mineral exploration will depend on aircraft. When the company was launched, I said that more development would result from the use of airplanes by experienced men in the next five years than had been accomplished in the last fifty years. This has been demonstrated in a few months' operations. Below are enumerated a few of the advantages gained by the use of the airplane:

1. *Safety*—Since 1926, when the first serious air transport started in the Patricia district, there have been no casualities among air passengers, whereas about 42 men have lost their lives by the old methods.

2. *Communication and Supervision*—These are essential to effective prospecting. Our parties are at all times in touch with district engineers and headquarters, and receive help and advice on the ground when they need it.

3. *Morale*—Increased out of all proportion. Men are in touch with civilization and have had the worry and labor of transportation of supplies removed. They can apply themselves 100 per cent to prospecting work within a convenient radius of their main camp. For their purposes, this main camp is the equivalent of Timmins or Cochrane or any other town on the steel. When they are through with that particular locality, they, their canoes, and their supplies are transported to another area in a fraction of a day, and work is resumed.

4. *Aërial Observation*—Geological boundaries can be outlined roughly by an engineer or experienced prospector, and topographical features of the country can be supplied to the field parties in remarkably quick time. For example, last summer we had to do with a band of Keewatin rocks about 30 miles long and 2 to 3 miles wide, in a country possessing no convenient water routes, but with numerous little lakes big enough for aircraft. One party and airplane cross-sectioned roughly the whole of this area in seven days and got the information wanted. Two weeks previously had been spent on the same job, packing, with few results.

Bear in mind that transportation is probably the biggest problem the prospector has to face, and when the airplane eliminates this for him, you can use your imagination to picture the field before our prospectors.

I do not mean that it will ever be possible actually to explore for minerals by airplane. It is possible from the air to pick out formations in the barren lands, which are not timbered or overburdened, but for actual exploration the prospector must be set down on the ground. He can be carried in a few hours into districts that ordinarily could only be reached after weeks of travel. He can be kept in touch with his company and the outside world, and he can be supplied with food, explosives, and working tools.

I wish to point out here that airplane exploration, instead of adding to the dangers of a pioneer country, actually renders the work much less hazardous. During all of our flying last year, there was not a single crash, and we were constantly in touch with all the men working from our air bases. There is practically no danger of a man being lost in the brush or starving when he is in our service, and little danger to the pilots, as airplanes are always sent out in pairs. The different bases know each day where every airplane is operating and where every man may be picked up.

We have now three large camps in the North which are stocked with two years' provisions, and we have 26 bases where gasoline and oil are cached. With a flying range of 1,000 miles, this means we can be in almost daily contact with every mineral section of Canada. For special missions, we have engineers and large airplanes in readiness.

One of the most important bases of the company will be at Sioux Lookout, Ontario. Owing to the develop-

Pickle Lake, Ontario, camp of Northern Aerial Minerals Exploration

ment in which the company is interested in the district of Patricia, it became necessary to have a complete staff and equipment within easy reach of this field, which undoubtedly is destined to play a most important part in the development of Ontario's standing as a gold-producing province. We are moving our hangars from Winnipeg to Sioux Lookout, and our field office also is being transferred there from Hudson. We are installing an assay office at Sioux Lookout, not only to take care of our three development operations and our own prospectors in the field, but to handle assays for prospectors in the district, who are now unable to come out to steel with their samples. As our airplanes will be making regular calls at certain bases, prospectors will be able to bring in their samples and later secure their assay results.

As an example of the activity of our force, even in the winter weather, we recently have taken in to our Crow River properties eight tons of supplies; 25 men, including surveyors and engineers, to survey and thoroughly examine our new Crow Lake gold discoveries; and we have flown-in men to our Shoniah Lake properties to open up the veins and prepare for sampling. We also recently sent two airplanes to bring out men who have been working on the east shore of Hudson and James bays.

We are operating in a country which has tremendous rewards for those who are highly organized, know the game, and are bold enough to strike deeply into the new areas. Northern Canada is such a rich mineral country that it may pay back enormous outlays through a single discovery. And, as testified by the hundreds of applications we receive, the young men of this country are more and more turning to the North as the land in which they must work and claim for their own. The airplane will be their chief ally.

Recent Operations of the N.A.M.E. Company

Flying carried on by Northern Aerial Minerals Exploration during the winter months, and since Mr. Hammell presented the foregoing paper at the March meeting of the Canadian Institute, has totaled about 15,000 miles. Details of this flying appear in the company's record of operations as follows:

Two large 400-hp. airplanes were sent along the east coast of Hudson Bay as far as Richmond Gulf under the command of Captain H. A. Oaks. This flight was made to communicate with company prospectors who were left in the Richmond Gulf area for the winter. The planes were delayed in returning, owing to bad weather, but reached their base at Sioux Lookout without a mishap, after a flight of about 1,900 miles. A party of sixteen men were engaged in surface development at the company's property on Crow River, in the Pickle Lake area. These men were taken in by airplane and supplies were also taken in from time to time during the winter months. A warehouse was built on Pickle Lake and the airplanes carried in sufficient supplies to last the working party for the break-up period and well into the summer.

The winter work on the Crow River property developed a rich gold showing about 252 ft. in length and 5.6 ft. wide. Two company prospectors located an extensive mineralized zone containing disseminated copper on Wendigo Lake, which is 220 miles north of the Sioux Lookout base. A mining engineer is at present engaged with a working party in developing this showing. A property on Shoniah Lake, in the same general area, was optioned and a working party taken in by airplane to do surface development work. As the mineralization on this property was not sufficiently encouraging to justify the exercising of the option, the company's parties were withdrawn. A working party was taken into the O'Sullivan Lake area to investigate a copper showing which was staked by N.A.M.E. prospectors last fall. These men are there at the present time, and they have sufficient supplies to last them into the summer.

In view of the fact that one month's good prospecting can be done before the ice leaves the lakes in northern Canada, fourteen prospecting parties of two men each were placed in favorable areas in Patricia, and six similar parties were placed in the Manitoba area. All these men were placed in the field with company airplanes, and each party has a sectional canoe which is also carried by the airplane. Sufficient grub to last into the summer was taken by each party. It would be impossible to carry on this work without the use of the airplane.

Two large airplanes with a party commanded by Thomas Creighton, the discoverer of the Flin Flon mine, in northern Manitoba, left a few days ago for the west side of Hudson Bay. This party will prospect in the vicinity of Chesterfield Inlet, on the west side of Hudson Bay. Sufficient supplies and gasoline were sent into this area last fall by boat to carry on the work for this season.

Importance of Mining Stressed by Scott Turner Over Radio

"MAKING MINERALS SERVE HUMANITY" was the title selected by Scott Turner, Director of the U. S. Bureau of Mines, for a radio talk from station WRC in Washington recently, wherein he told briefly of the history and importance of the mining industries.

"The pioneering spirit displayed by countless miners has been responsible in large measure for the gratifying position which our country occupies today in mineral production," said Mr. Turner. "The value of the annual production of the primary mineral industries of the United States, including metallurgical works and oil refining, amounts to eighty-three hundred million dollars. But this figure tells only part of the story. Many other manufacturing industries depend on the mines for their raw materials. The additional values created by the metal-working industries and others fabricating minerals, over the cost of the raw material, amount to another eighty-five hundred million dollars. Thus, the total values created annually by the mines and the mineral-using industries amount to seventeen thousand million dollars.

"The raw products of the mines constitute 51 per cent of the revenue freight tonnage of the nation. Manufactures of raw minerals, such as gasoline, iron and steel products, cement, and clay products, contribute 14 per cent of the tonnage, so that the mineral industries contribute 65 per cent, or approximately two-thirds, of all the revenue freight tonnage which supports the country's far-reaching network of railways.

"The United States, with but 6 per cent of the world's population, produces 40 per cent of the world's aluminum, 60 per cent of the world's smelter copper, 51 per cent of the pig iron, 45 per cent of the smelter zinc, 39 per cent of the coal, 71 per cent of the petroleum, 38 per cent of the phosphate, and 70 per cent of the world's sulphur."

KENNEDY MINE

Replaces Its S

By GEORGE J. YOUNG
Associate Editor

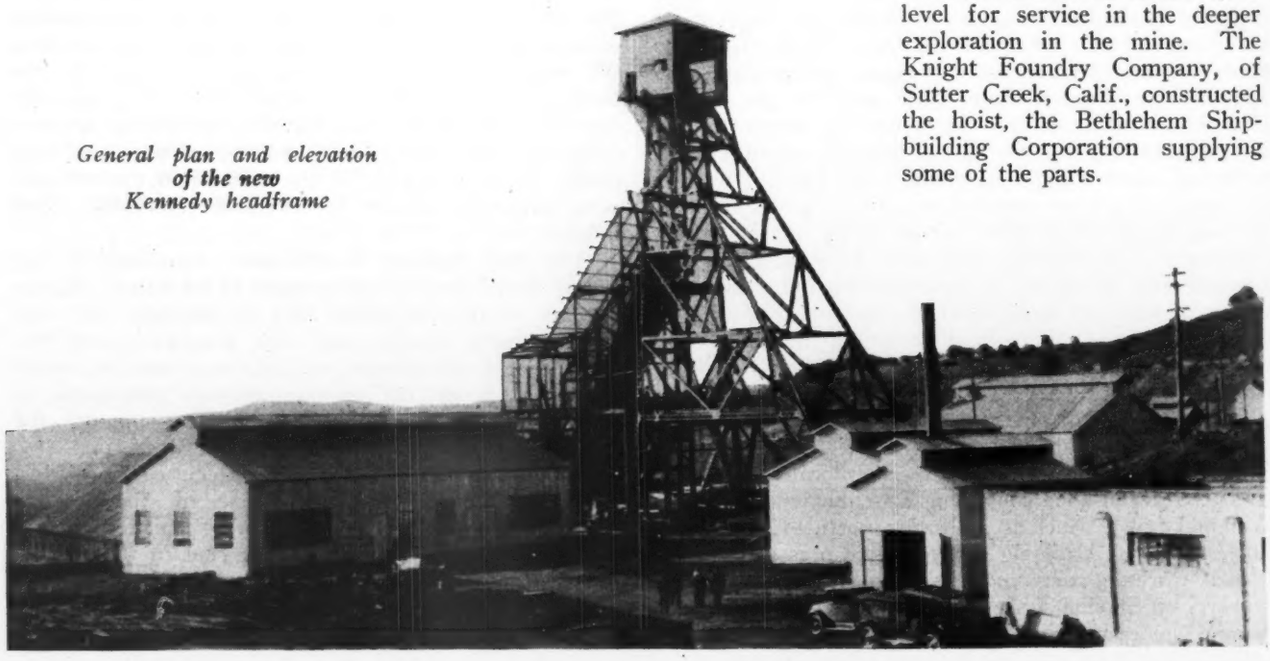
THE new surface plant at the Kennedy mine, near Jackson, Calif., should be of general interest to mining men, in that it represents the latest work on the Mother Lode in respect to mine surface equipment and buildings and may be expected to have more or less influence on other installations. On Sept. 7, 1928, a fire destroyed the surface plant as well as a new steel headframe that was under construction. Only the office building and the mill escaped. The surface was cleared and construction of new buildings began. On Feb. 17, 1929, the skips were placed in operation and unwatering of the lower levels of the mine was begun. All of the new buildings have been completed, and their equipment is being installed.

The change house (44½x66½ ft.) is of brick wall construction with steel-trussed roof and steel window frames. Lighting is provided on all four sides, the window line being above the top of the lockers. The floor is cement, and showers and other fixtures are close to the entrance end of the building. Berloy open steel lockers, 2x2x4½ ft. inside dimensions, to the number of 160 are provided. Heating and hot-water service is provided by a steam boiler in a separate steel-frame, galvanized corrugated steed building (20x32x15 ft. high) near by. The machine, blacksmith, and drill-sharpening equipment is housed in a steel-frame galvanized corrugated steel building (42x80x16 ft. high) east of the shaft. As in the other buildings, steel sash is employed, and a ventilating louvre extends the length of the roof. A partition divides the machine shop from the blacksmithing and sharpening room. A few machine tools, radial drill, lathe, and planer have been retrieved and installed, but the drill steel sharpening outfit remains to be placed.

Of the same type as the others is the compressor building (30x50x15 ft. high), which houses three Ingersoll-Rand duplex, Class PRE-2 compressors, direct-driven by 225-hp. Westinghouse, 440-volt, synchronous motors at 257 r.p.m. Cylinder dimensions are 12½x14 and 20x14 in. A three-panel switchboard contains the starting and control units.

The timber framing shed (36x90x14 ft. high) is of steel-frame, corrugated galvanized steel, open at the side toward the timber pile and also on the end toward the shaft, and it will be equipped with a timber frame made by the Knight Foundry Company, and also with a wedge saw and a cutoff saw.

The hoist house (45x40x16 ft. high) is of the same type of construction and contains a temporary hoist. Subsequently this hoist is to be replaced with another better adapted to the mine service. The temporary hoist will then be transferred to the 4,650 level for service in the deeper exploration in the mine. The Knight Foundry Company, of Sutter Creek, Calif., constructed the hoist, the Bethlehem Shipbuilding Corporation supplying some of the parts.



General plan and elevation of the new Kennedy headframe

Design represents latest practice on California Mother Lode . . . . Headframe built around old structure before the latter was dismantled

Its Surface Plant

The new ore bin at the Kennedy shaft. Note the clearance obtained at the hoist house by trussing the back legs of the headframe.

As it was desired to recover the lower levels as speedily as possible, time was economized by this arrangement. The hoist is of local design and is similar to that in use at the Argonaut mine. The double drums, each equipped with hand-operated post brakes and spur gears, are 6 ft. 1½ in. in diameter by 35 in. face. Eight wraps of the 1⅛-in. steel cable must be made to accommodate the length of hoisting rope. A 500-hp. variable-speed General Electric motor, of 2,200 volts, drives the pinion shaft through a speed reducer. Hand-operated jaw clutches through the pinion gears bring the drums into action. A 7-ft. diameter braking wheel is provided on the pinion shaft, the post brakes being operated by foot power. This brake serves for ordinary operation with the skips or cages in balance. Opposite to the pinion side is an auxiliary shaft with pinions meshing with the drum gears, and on each side are 5-ft. diameter braking wheels with post brakes, also hand operated. Thus three sets of brakes are available for the control of the hoist, the drum post brakes, the auxiliary brakes controlling through the secondary pinion shaft, and the post brakes on the pinion-shaft braking wheel. This last is a split wheel with a heavy rim held together by a bolted hub and steel keys. (This type of construction has been employed to permit the hoist to be taken through the shaft. All parts are sectionalized for this purpose.) Brake blocks are composed of alternate wood and asbestos inserts. Other post brakes are provided with wooden shoes.

The Kennedy main shaft contains three compartments, each 4 ft. wide by 5 ft. The maximum depth with sump is 4,762 ft., the lowest level being the 4,650. Guides are 4½x4¾ in. in section. The steel headframe is of special interest. It was designed by Henry D. Dewell, of San Francisco. Mr. Dewell stated, as one of the special conditions, that the new headframe was to be built around the old wooden headframe. This necessitated somewhat wider dimensions than would otherwise have been required. Initial design and construction were predicated upon a minimum delay to mine operations in changing from the old to the new headframe. The position of the old headframe and its inflammable nature were responsible for the destruction of the new headframe at the time of the fire. Another headframe was fabricated, the ruined steelwork of the old being salvaged to some extent.

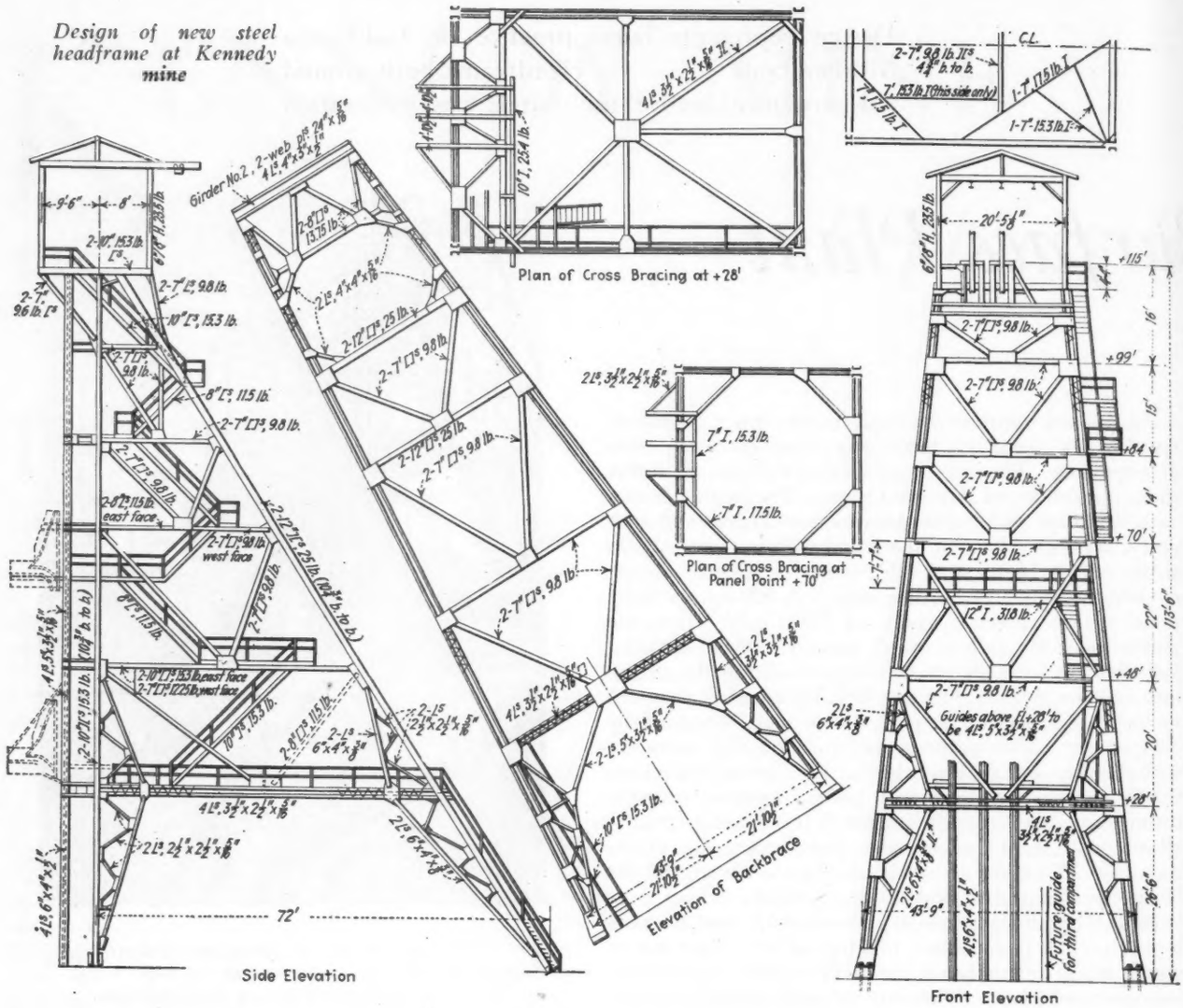
Mr. Dewell stated that the headframe was designed to withstand the following conditions: dead loads; working loads; ropes breaking while skips are in shafts; ropes breaking while skips are jammed against guides in headframe; and wind pressures from any direction. For working loads, stresses in the ropes have been taken as the weight of rope, friction of rope, bending over head sheave, weight of skip and load, and impact caused by starting and stopping the load. The headframe was also designed to provide for two inclinations of the hoisting rope, one for an auxiliary hoist and the other for a new hoist, to be installed, at some future time, back of the present hoist house. In place of the auxiliary hoist, a temporary hoist, as has already been mentioned, was installed.

The principal dimensions of the frame are: width parallel to shaft length, 43 ft. 9 in.; length traverse to long dimension of shaft, 72 ft.; height to sheave centers, 113 ft. 6 in.; diameter of sheaves, 10 ft.; rope diameter figured in design, 1¼ in.; ultimate strength of rope, 138,000 lb.; weight, 2.45 lb. per foot; weight of skip, 6,400 lb.; weight of load, 8,000 lb.

The back legs of the frame are two 12-in. channels, 25 lb. per foot, 10¾ in. back to back and laced; front legs are two 10-in. channels, 15.3 lb. per foot, 10¾ in. back to back and laced. Alternate sections, 12 in., 65 lb. per foot H-section and 10 in., 49.5 lb. per foot H-section for the front and back legs, respectively, were allowed by the designer but were not used. The frame is divided into six panels. Details are given in the accompanying figure.

Particular study was given to secure a frame con-

Design of new steel headframe at Kennedy **mine**



sistently strong in all its parts and with general stiffness against vibration. To provide clearance on all four sides of the bottom panel, both posts and back legs were trussed to take care of the bending stresses caused by the omission of the diagonals. The "K" system of trussing in the sides of the frame was adopted because it is rigid and economical. Mr. Dewell pointed out that in this type of bracing all members are rigid and against lateral forces all members are working. The bracing in the horizontal planes permits the sheaves to be lowered through the headframe without interference.

Overhead beams for an I-beam trolley are provided, so that sheaves can be removed vertically from their seats and by means of the trolley run into position for lowering. One trolley only is provided, and this can be shifted to the second beam when necessary, the lower flanges of the trolley beams being cut away for a short distance to facilitate this shifting. The weight of the trolley is 200 lb. and the steel sheaves each weigh 3,500 lb. Provision is also made for utilizing the third compartment of the shaft for hoisting at any future time. The weight of the headframe is about 100 tons.

In designing the new steel ore and waste rock bins the old arrangements were followed. Two skip discharges are provided, one for waste rock and the other for ore. At a lower point a discharge is arranged for the water skips. The ore grizzly is arranged to discharge at such a point as to utilize most of the ore-bin capacity, which is estimated to be about 600 tons. Inside removable linings are provided for portions of the bins and chutes which receive the hardest wear. Platforms are provided at the ore and waste rock dump levels. Oversize of the grizzly discharges to the rock breaker. Metal stairs are provided throughout frame and ore bin. The weight of the steel bins is about 180 tons.

The new surface plant of the Kennedy Mining Milling Company, at Jackson, Calif.

For changing skip and cage a curved I-beam is placed about 15 ft. in front of the center line of the shaft. A trolley and chain block are used to handle the shaft vehicles. The I-beam track extends toward the shop and occupies the full width of the frame, thus affording room to handle all of the shaft vehicles.

Steel fabrication was done by the Moore Dry Dock Company, of Oakland, Calif., V. C. Garbarini superintending the work of erecting the steel and machinery.

The capacity of the Kennedy mine is from 200 to 250 tons of ore per day. Waste rock is relatively small in amount and but little is hoisted to the surface. Mine labor is about 160 men. Apart from the general mine service and ore hoisting, the Kennedy mine has been drained by hoisting the water from the sump and from tanks at the 500, 1,000, and 1,900 levels. Other levels are also provided with water tanks. Water skips of 1,100-gal. capacity are used. The mine makes an average of about 80,000 gal. per day. At present about 40,000 g.p.d. are being handled through the Argonaut mine. With the new facilities and a hoisting speed of 900 ft. per minute, about one shift will be required for hoisting water.

To lift water from below the 3,600 level 5.5 to 6.5 min. is required per trip. At present the hoist is being used for bailing. The engineers expect the mine to be drained and ready for operation soon. On March 1, 1929, 4,500 level had been reached, and unwatering was progressing at the rate of 200 to 220 skip loads, 1,100 to 1,200 gal. each, per day.

Scientific Research and the Government

APART of the address delivered by Ray Lyman Wilbur, Secretary of the Interior, at the fifteenth anniversary of the foundation of the United States Geological Survey, follows. Another excerpt from it was published in the news columns of the March 30 issue of *E.&M.J.*

"Our civilization is being made over right before our eyes under the stimulation of the forces set loose by discovery, research, and invention. This new physical world has a firm basis upon undeviating universal laws. It is probably true that we have available a mere fragment of the great structure of knowledge which will eventually be brought into the service of man. Our viewpoints are rapidly changing. Old assumptions, theories, and dogmas are being rapidly pushed out of our minds. In this period of mental ferment, shams have been exposed, the taboos of centuries released, and much has been brought up for discussion which was considered settled by our forefathers.

"In the field of government there has been a rapid increase of democracy. To an increasing degree, science has become definitely associated with the development and functions of government. This is the age of democracy and science. Science has no sympathy with substitutes for the truth. Science is giving the human family a unique and unexampled service, and through it the human mind has been vastly increased in its range and mental power.

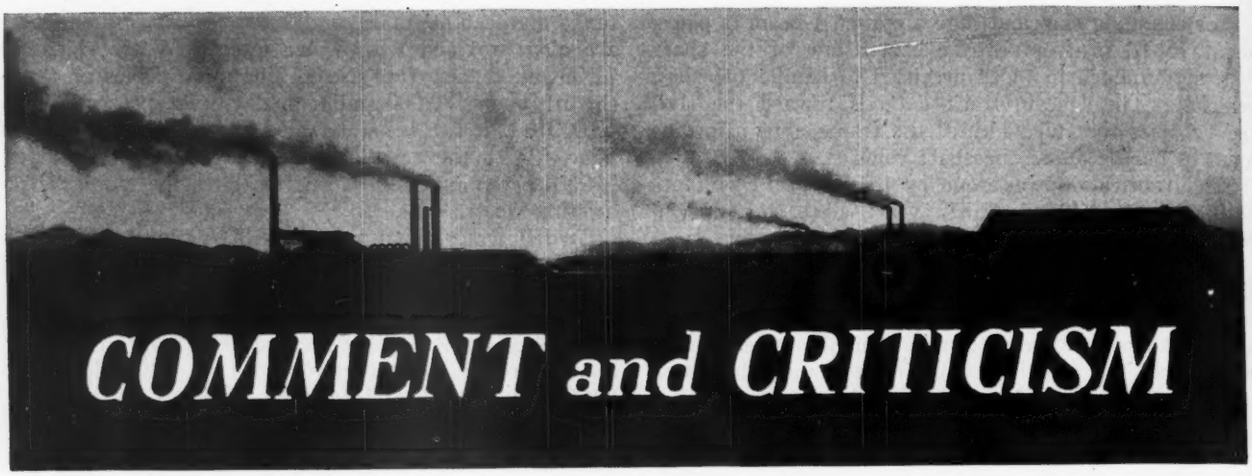
"With the development of the democratic idea and the elimination to a large degree of the divine right of rulers, the necessity of wise leadership selected by democratic processes becomes a paramount need. This is the day of the expert. The man who knows must be recognized and used. In the fields of science the experts can be trained and developed, but such experts require opportunity for long years of study and they need constant exposure to those who are devoting their lives to research; in fact, progress in our modern civilization is going to depend upon the experimental method rather than upon catchwords, aphorisms or the persistent broadcasting of untried ideas. So close today is the link between science and its laboratories and the government that we can measure the progress of a civilization by its economic capacity to support laboratories and by the quality of the intellects brought into them.

"It has been customary, in providing for the needs of agriculture, public health, and in other fields, to set aside a certain amount of money and certain bureaus for those studies requisite for security. There has been too a fortunate tendency to increase the amount of work done in government laboratories which can be classified as of a fundamental character—that is to say, searching for truth for its own sake rather than for practical procedures immediately applicable to daily life.

"Essentially, research depends upon a large amount of reserve time which can be used by men of great curiosity and industry without the supervision of others except in the broadest way. The ordinary administration of government, the ordinary handling of budgets, do not lend themselves well to research. It requires its own technique. In it there will always be an apparent waste of time and false leads. Most leads in the great unknown are apt to end blindly. The discovery of new facts which, once discovered, become the eternal property of mankind is full of hazards and beset with many uncertainties.

"In some ways the research worker has as hard a task as that of a blind man trying to thread a needle. Many attempts must be made before success is assured. Because of this it is most important for the modern democracy to set up its relationships to science from the standpoint of the budget in such a way that funds will not be tagged for specific purposes. Funds should be made available for the securing of the best brains possible and for the facilities that they require, in order to pursue the unknown. Though this function is carried on by many independent institutions and as a part of great industrial concerns, it seems to me that, since science and government are so closely related, government itself must make liberal grants for the support of investigation and research.

"In the new world's civilization which is now a world-wide structure, interlocked economically and with all kinds of interrelations and intercommunications, a new conception of world citizenship is developed. Truth discovered by the citizen of any country can readily become the property of all. A democracy which is not seeking for new truth and new facts can no longer consider itself safe in this world of harsh reality, where facts determine the issue. These facts applied either to industry or to national defence determine not only progress but even safety."



COMMENT and CRITICISM

Prospectors in Search of Capital Should Avoid the Fair Sex and Cultivate the Successful Business Man

To the Editor of "E.&M.J.":

Frequent recent contributions to *E.&M.J.* on the disappearance of the prospector, or words to that effect, have annoyed me to such an extent that I have decided to reveal all.

The number of prospectors has increased, not decreased. The failure of the prospector to interest capital is due to his unfortunate choice of sources of money.

As a matter of fact, the last person to expect to be interested in a prospect is a mining company or a mining engineer. Please note that I say "in a prospect." A prospect is always a long chance, and no one knows this from experience better than a mining company or a mining engineer. Therefore, the prospector is simply wasting time with them.

During the period when money was available for developing prospects, the mining company did not exist. In fact, history shows that there were even few mining engineers. The prospector therefore was then forced to do what he should do today. He should look for money among the people of imagination in mining matters, such as storekeepers, bankers, dentists, and successful business men. Naturally, the banker will not lend bank money, but he is always ready to buy a few shares with spare cash, which he "can afford to lose." Witness the flood of oil shares sold to New York bankers. A banker is never completely satisfied with his salary nor with a safe 6 per cent. It is not necessary nor even advisable to protest to a banker that the prospect is a "sure thing" for 1,000 per cent profit. Tell him it seems to you like 1,000 per cent, and he will say to himself, "if it turns out 500 per cent I will be satisfied."

Successful dentists exist in large quantities, and though their money comes easy, they cannot get beyond a certain income, and are always ready for a flier. I know one dentist who backed a Bolivian prospector with $30,000 after filling three teeth for him—a matter of two hours' interview, with the added handicap that for more than half the time the prospector's mouth was full of rubber!

The successful business man, however, is the best large source for money. Of course, the young man who has inherited a fortune is a good source, provided he has free disposal of his money and has no banker friend of his father to whom he looks for advice. The rich heir, however, is available only in small numbers; whereas, the successful business man is far more numerous. The former is likely to want to go to the mine and take part in the work, whereas the business man buys only a few shares and allows the prospector full control.

Furthermore, the successful business man will hold on longer. When the prospector's first expectations are not realized, the successful business man is likely to apply his experience gained in business and say confidently: "It is only necessary to spend enough money intelligently in order to make a mine out of any prospect." I feel that he may be wrong about this. Nevertheless, this does not detract from his desirability as a backer of a prospector. It is exactly such men who have been back of the successful mines of the world, beginning with the Homestake, through the early South Africans, and ending with the now big tin mines in Bolivia.

It is not necessary to tell a successful business man that you go to him not so much for his money as for his valuable co-operation. He already knows how valuable his assistance will be, because he has made success after success and knows that he will be equally successful with a mine if he has the necessary time to devote to it.

There is one other source of money for the prospector, but it should be avoided like the mosquito in Rio, if the prospector wants to live comfortably. Women are the worst backers he can find, and sooner or later his conscience will find him out and give him gray hairs. Besides, sociologically and financially the male provides for the female, and not the contrary.

To sum it all up, the prospector should walk down the main street of some city far from Denver, Joplin, or San Francisco, and call on the successful business men with the largest stores. Pittsburgh is good. Detroit is fine, and automobile makers are fine backers. But New York is the best American city and London is the best in the world. Keep far away from promoters, the big "houses," and the engineers.

Any further advice on this subject from me will cost a consulting retainer.

MARK R. LAMB.

Buenos Aires, Argentina.

A Suggestion for Dowsers

To the Editor of "E.&M.J.":

As to the many arguments over dowsing, I consider the remarks made by Professor A. Kump, of Braunschweig, during a lecture he gave in Vienna, Sept. 20, 1928, the most conservative statements on dowser activities I have read. A translation of them appeared in the *E.&M.J.*, Jan. 5, 1929. However, I do not agree with everything he states. Not being a professional dowser myself, but experimenting with the divining rod as a pastime, from my own experience and for the benefit of serious students of the problem, I would like to add the following:

Not to those who, as Professor Kump states, often use the movement of the rod as a trick to make humanity believe that they possess a special gift, but to those that are earnestly interested in the problem, I would suggest the following:

Construction of what I would call a mechanical rod: that is to say, a rod

supported by special means and not resting inside of the palms of the manipulator's hands, the movements of which rod will be brought about whenever the operator places his hands on its two ends. This would eliminate the risk entirely, and do away with the ground for the often repeated accusation, that the rod is made to move through suggested muscular contraction.

The serious manipulator ought to work with an absolutely blank mind. That is something difficult to accomplish, and contrary to the rules of most dowsers, who approach their task with minds concentrated upon the subject sought. In such tests, supervised by an observer, little danger of autosuggestion or suggestion by other persons would exist.

CARL HANSSEN.

Zacualpan, Mexico.

The Study of Geology By Airplane

ON JAN. 12, 1929, my class in "Sedimentation" at the University of Southern California took an airplane trip along and over the Whittier Hills and Santa Ana Mountains, east and southeast of Los Angles, Calif., writes Arthur J. Tieje in *Science*. The plane, a four-passenger type, was supplied through the kindness of the Stoody Company. It is believed that this was perhaps the first use in the United States of an airplane by an entire geology class. Since each student was aloft an hour and a half, it has seemed worth while to record their impressions and to ask for suggestions from other schools that may be planning flights, or may perhaps have antedated this one.

The students had already spent a semester in studying the peneplained Triassic basement complex of quartzites and slates, shot with Jurassic intrusives and partly overlain by Jurassic (?) extrusives; as well as the Cretaceous and Eocene formations, chiefly heavy sandstones where exposed in the Santa Ana region. All the formations are tilted into an unsymmetrical anticline with its gentler dip to the southwest and complicated by a dome-like anticline striking north-south on the western flank of the major structure.

We were uncertain as to how much could be observed from the air during the time each student was allotted. Accordingly, directions were given to center attention on four points:

1. A fault which runs along the entire southern front of the Whittier Hills.

2. Terraces, caused by the latest uplift, along the canyons of the Santa Ana Mountains.

3. The contacts between Triassic and Cretaceous, Lower (?) Cretaceous and Upper Cretaceous, Upper Cretaceous and Martinez Eocene, Martinez and Domengine (?) Eocene.

4. The great Perris peneplain to the northeast of the Santa Ana Mountains. This plain had never seemed to the students a base-leveled region, because, observed from the earth, the flatness is obscured by elevations, numerous, highly irregular in shape, and often five hundred feet high.

I accompanied each group of three. After the first gazing at the ground was over—some of the students had never been aloft—the three began to take notes. Note-taking, as well as the use of topographic maps, proved easy for the better students. I made occasional suggestions, but most of the time confined myself to observing the elevation and the effects of differing elevations on accuracy and range of vision. The following comments upon what could and could not be well observed are based chiefly on papers (one and a half pages, typewritten) required later from each student.

1. Observation of faults: Physiographic evidences of faults seemed to be noted by all. Though the particular Whittier fault suggested for consideration was merely guessed at by all but two students, who connected a scarp behind the Brea oil field with the fault, another fault, the San Jacinto line, which bounds the Perris peneplain to the northeast of the Santa Ana Mountains, was observed by about two-thirds of the students of their own initiative.

2. The river terraces, caused by uplift, were not well located; at least, statements concerning them were vague. On the other hand, a partially dissected and uplifted fan-terrace, never observed from the earth except as the students dutifully "knew" it was there, attracted their eyes as something plainly discernible and "new."

3. The contacts were variously estimated as "clear" to "obscure." A color change between the red of the Lower (?) Cretaceous and the gray of the Upper Cretaceous was rather generally located. Frequently, also, mention was made of "being able to see the continuity of a contact across canyons and divides." Such observation strikes me as very valuable, even if the exact bed was wrongly allocated.

4. The Perris peneplain was observed with enthusiasm and very early. "From 1,900 ft. the hills on what we had been told on auto trips was the peneplain looked like bumps on a wide stretch of flatness."

Students seemingly were able to observe, though scatteringly, more than the required four points. Straightness of certain streams, youthful and mature topography, springs along fault lines, braided rivers, arrangements of oil wells, the shape of Santa Catalina Island far to the west, the asymmetricality of the Santa Ana Mountains from an elevation of 4,500 ft., silver mines in a dike ("I see now it *is* a dike," wrote one student)—these and other details drew comment in one or another paper. Average strike and dip of formations were often determined, though Brunton compasses were unusable.

On the whole, then, the experiment was a success, particularly in giving a bird's-eye instead of our ordinary ant's-eye view. The visibility was excellent; at 1,900 ft., our average elevation, gas station signs were entirely legible. The speed was about 100 to 115 miles per hour.

We plan, in connection with a field geology course for the same group of students next semester, to fly over a region unknown to them. If, as seems probable, this flight can be preceded by one over known territory, so that the students become accustomed to taking notes in the air, the results of the third flight should be very interesting.

Two Safety Points in Handling Explosives

To the Editor of "E.&M.J.":

In your issue of April 27, 1929, Mr. M. J. McCarthy's writing on the subject of "Safety from a State Metal Mine Inspector's Point of View," gives a number of suggestions on safety which, from an explosives manufacturer's standpoint also, are extremely good.

There are two points, however, to which I would call your attention. He says: "Cases containing explosives should not be opened in the magazine, and only implements of wood, brass, or copper should be used in opening the cases." The feeling that brass and copper are safe for opening cases of explosives dates from the time when black blasting powder was the only explosive commonly used, the idea being that brass and copper will not strike a spark in contact with other metals or rock. The Institute of Makers of Explosives, in its "Safety First Dont's," dynamite case inserts, and other literature, recommends that cases containing explosives should be opened only by means of a wooden wedge and wooden mallet, or a wooden wedge and fiber mallet. We consider it dangerous to use even brass or copper in opening dynamite cases, especially where a leakage of nitroglycerin has occurred and where the brass or copper is likely to come in contact with the nails.

On the other hand, Mr. McCarthy, in the twenty-first injunction regarding explosives, says, "Never use a candlestick or other metal punch to make a hole in the powder." We do not consider it unsafe to use a metal punch for priming a stick of dynamite. In fact, nearly all of the modern cap crimpers made of steel are equipped with one leg pointed and curved, especially for this purpose, and as far as I know no accident has ever occurred from its use.

ARTHUR LA MOTTE.

Wilmington, Del.

[We are thankful to Mr. La Motte, who is manager of the technical section of the Explosives Department of E. I. du Pont de Nemours & Company, for calling attention to these two points.—EDITOR.]

BY THE WAY

Hoover Devised Appraisal System Used in Michigan

THE MINES of Michigan are appraised by a system devised many years ago by Herbert Hoover, which was modified slightly by J. R. Finlay, who made the first appraisal in 1911. Since then a member of the geological staff of the State Department of Conservation has acted in the capacity of appraiser of mines and mineral resources for the Tax Commission.

A mine is appraised differently from ordinary property, as it is a wasting asset and each year that it is operated is worth progressively less. The only value a mine has is its ability to produce ore at a profit, and the more it produces the less it has in reserve. New discoveries, increases in ore prices, and lower production costs are factors which tend to increase the value of the mine. The Hoover or Finlay system of appraisal takes all these factors into account in valuing a property, giving proper weight to the questions of resources and profit obtained from the sale of the ore. Expected profit for the ore that is to be taken out is arrived at under the Finlay system by determining the profit per ton during the last five years, using this experience as a guide for future earnings.

American Philosophy and "The Luck of Roaring Camp"

IN AN INTRODUCTION to a reprinting of Bret Harte's "The Luck of Roaring Camp," appearing in the April number of *The American Legion Monthly,* Mr. John Erskine holds that Bret Harte, in selecting the life of the miner for his subject, found a vehicle for expressing the philosophy of the American people. This and other views in Mr. Erskine's introduction are of unusual interest and make Bret Harte's story of the early mining days in this country stand out in even more marked relief than heretofore. Excerpts from the introduction follow:

"'The Luck of Roaring Camp' appeared in the *Overland Monthly* for August, 1868. It was the first picture Bret Harte gave us of his special subject—the romantic West in the gold period.

"The humor (of the story) is so broad as to be grotesque. The incident of childbirth in such a place, the unusual food-supply for the infant which the miner, acting as nurse, improvised, the extraordinary mixture of emotions entertained by the miners for the defunct mother, are all in the American mood. Perhaps the humor seems less grotesque than it actually is because of the adventurous world in which the story is located. Anything might happen, the reader supposes, in such a place as this wild mining camp. So well are we prepared for extraordinary events that we accept somewhat easily incidents and facts we might question in another environment.

"The sympathy of this wild crowd, a sort of democratic fellow feeling, is one of the charms of the story, though it pervades the pages so subtly as often to pass unmentioned. It is flavored by pathos and by the peculiar kind of sentiment which I think is typically American—not that other nations lack it, but that we specialize in it. The pathos of the woman's death, the loneliness of the men in a world without tender elements, the power of the child over their imagination, make a total impression which is hard to define but easily recognized.

"The European has often pointed out that the American, whether he thinks it or not, is a fatalist. Usually an optimistic one—that is, believing in his own or in his nation's destiny; in any case, fairly resigned to whatever is to be. In selecting the life of the miner for his subject, Bret Harte found a vehicle for this philosophy of ours."

Chemistry as a Field for the Vanishing Prospector

THE introduction of "big business" methods into the field of exploration has left the would-be lone prospector high and dry. There is perhaps plenty of adventure left in the mountain trail; but if he would seek his fortune let him become a chemical prospector and remain in his laboratory. There let him search for rare metals among those which are already plentiful, but rare in the sense of properties peculiarly adapted to some specific purpose.

There are many of these metallic loafers. One has but to read through the list of chemical elements to find this out. And many of them could be obtained in abundance if need arose and chemical methods were properly developed. Here is an inspiring field for the chemical explorer.

—The New York *Herald-Tribune*

Our Oldest Reader?

WHO is the oldest reader of *E.&M.J.*? Who has a record for the longest continuous subscription? We shall be glad to hear from some of the old-timers, and under what conditions they began to read the magazine, and what they think of it now compared with their first impressions. These thoughts are brought up by the receipt of a letter from Mr. H. G. Moulton, who, in transmitting a check for a subscription for his father, Mr. G. B. Moulton, of Baker, Ore., says:

"I imagine that my father is about the oldest reader of *E.&M.J.*, for he will be 92 next September. He has been interested in mining since the early '60s, having been a pioneer miner in California at about the beginning of the Civil War. He was also one of the pioneers in British Columbia, and in Alder Gulch, Montana. Later he operated the Queen of the Hills mine, at Bellevue, Idaho, and the lead smelter at Ketchum, in the same state.

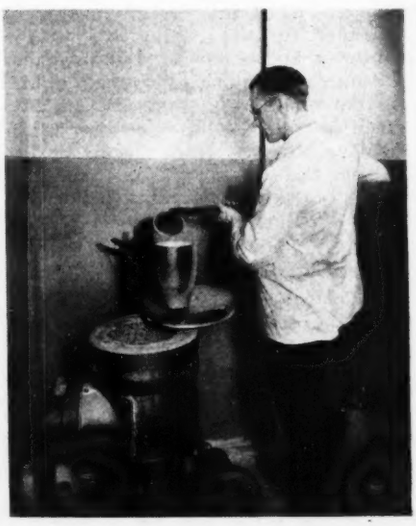
"I suppose it is the good background of the mining industry that enables our old pioneers to keep up their interest in mining and in the *E.&M.J.*, even into the nineties."

Gold Goes Into the Stetson

STETSON hats have long been recognized among mining men as practically an essential part of field equipment, and, along with the prospector's burro and beans, this particular make of headgear has been intimately associated with the discovery of many mineral deposits. It is gratifying therefore to learn from a recent announcement of the John B. Stetson Company that metal, in the form of gold leaf, is used in the manufacture of the company's products, and that the reclamation of gold in the factory where the hats are made is valued at more than $10,000 annually.

The gold reclaimed is found in leather and paper sweepings and "skewings" which accumulate while $50,000 worth of gold leaf is clipped and punched in the marking of hat bands. This refuse material, containing the gold, is swept up and carefully baled. Once a week the bales are charged into a reducing furnace with suitable fluxing agents, and $150 to $250 in gold is reclaimed. The metal is exchanged for currency at the Philadelphia mint.

Recovering gold from waste material used in stamping hatbands



Personal Notes

E. N. Hickman, of the sales department of the American Metal Company, is in Europe.

R. G. Hall, metallurgical engineer, of San Francisco, has returned to that city from New York.

P. Bouery has returned to California from France. He will be in Siskiyou County for the next month.

Stephen S. Tuthill has announced his resignation as secretary of the American Zinc Institute, effective Aug. 1.

A. Franchie, metallurgical engineer, has left Guadalajara, Mexico, to visit Vancouver, B. C., and Seattle, Wash.

Louis D. Huntoon, consulting mining engineer, has changed his New York office address from 2 Rector St. to 15 Park Row.

Sir Oliver Lodge spoke before the Institute of Metals in London on Tuesday, May 7. His subject was announced as "Some Ideas About Metals."

R. M. P. Hamilton is in charge of a branch office recently opened by the General Engineering Company at 350 Bay St., Toronto, Ontario.

Clinton Crane, president of St. Joseph Lead, will deliver the commencement day address at the Colorado School of Mines, in Golden, on May 17.

Marshall Haney recently made a preliminary examination of a group of mines near Gold Hill, N. C., for Birmingham and New York interests.

T. R. Holmboe has resigned as superintendent at the Bethlehem Cuba Iron Mines, and is now with Consoer, Older & Quinlan, consulting engineers, Chicago.

Etienne A. Ritter has just returned to Denver, after examining mining properties near Wickenburg, Ariz., and Silver City, N. M., for European financial interests.

R. E. Myers is in charge of operations at the Jumbo property in the Breckenridge district of Colorado, where shipments of gold-silver-copper ore have been started.

George Otis Smith, director of the U. S. Geological Survey, was recently in San Francisco in connection with projects for the conservation of petroleum resources.

G. R. Riegel, a member of the board of directors of Grandview Mines, has been elected president of Dickens Consolidated, succeeding **S. B. Holbert,** who resigned several weeks ago.

Lapsley W. Hope, formerly associated with W. L. Brandon in the practice of mining and civil engineering at Chattanooga, Tenn., has been appointed assistant superintendent and purchasing agent of Morning Glory Mining & Smelting, at Patagonia, Ariz.

S. G. Blaylock, general manager of Consolidated Mining & Smelting, of Canada, has returned to Trail after a tour through European chemical and metallurgical centers. **J. J. Warren,** president of the company, accompanied Mr. Blaylock on his trip from Montreal to Trail.

Albert E. Wiggin will succeed **Frederick F. Laist** as metallurgical manager of the Anaconda Copper operations in Montana. Mr. Laist will make his headquarters in New York hereafter, so as to be able to be in closer touch with the Chilean and Polish subsidiaries of his

ALBERT E. WIGGIN

company. Mr. Wiggin was born at Wakefield, Mass., where he attended the public schools and high school. He graduated from Massachusetts Institute of Technology in 1907, after taking a course in mining engineering and metallurgy. After graduation he started with the sampling department at the Great Falls plant of Anaconda Copper. In December, 1911, he was transferred to the concentrating department at the Washoe plant. During the next two years he carried on research work covering changes in the method of concentrating the Butte ores, especially the slime. During this research work, he visited the foremost copper reduction plants in the United States. Under supervision of Mr. Laist, Mr. Wiggin installed the round-table plant which very substantially increased the recovery of copper from slime over the old method. After paying for themselves many times the multi-decked round tables were scrapped and replaced with flotation machinery. In 1918, Mr. Wiggin was advanced to the position of general superintendent of the Great Falls plant, which position he has held until his recent promotion. For the present he will make his headquarters at Great Falls and operations at the Washoe plant will be superintended by **Louis V. Bender,** working under Mr. Wiggin. Besides his business connections, Mr. Wiggin has been prominent in the civic life of Great Falls and is a director of the First National Bank of Great Falls, the largest financial institution of that city.

H. W. Gillette, chief of the metallurgical division of the U. S. Bureau of Standards, has resigned to become director of the Battelle Institute at Columbus, Ohio. He will continue his work at the Bureau of Standards until the end of the present fiscal year.

O. C. Schlereth, mining engineer; **James Heggie,** metallurgist; **R. Winter,** metallurgist, and **Ernest Maurer,** construction engineer, have joined the staff of Mount Elliott, Ltd., which will reopen its properties in the Cloncurry copper district, of Queensland, Australia.

F. W. Bradley, president of the A.I.M.E., and Mrs. Bradley are now visiting the various Institute section headquarters. They were in Phoenix last month on the occasion of a "State Dinner of Industries" in honor of **Dr. L. D. Ricketts.** Mr. Bradley will attend the meeting of the Institute directors in New York and will return to San Francisco in June.

K. Murakami, superintendent of the Niihama flotation mill of Sumitomo Besshi Mines, Ltd., Niihama, Japan, recently made a trip through metallurgical plants of the West. In his visits he included the plants of Tennessee Copper, Miami Copper, Inspiration, Nevada Consolidated, Utah Copper, American Smelting & Refining at El Paso, and Silver King Coalition.

R. M. Preston, of the Rio Tinto Company, Ltd., has been elected a director of Minerals Separation, Ltd. Rio Tinto's increasing interest in Northern Rhodesian copper mines is reflected in Mr. Preston's election to the directorate of Minerals Separation, which is active in the management of several of the Rhodesian copper companies. Sir **Auckland Geddes** and **J. N. Buchanan,** also of Rio Tinto, will join the directorate of Rhodesian Congo Border Concession in the near future, according to an announcement of Rio Tinto.

L. O. Howard is in charge of a party of senior students in mining and metallurgy from the School of Mines of the University of Idaho that is making an inspection trip through the mining districts of the Northwest. The party will visit the Sullivan mine and mill, at Kimberley, B. C., and the metallurgical plants of Consolidated Mining & Smelting, at Trail. They will also inspect the mines, mills, and the Bunker Hill smelter in the Coeur d'Alene district, Idaho. **A. W. Fahrenwald,** professor of metallurgy, and **A. L. Anderson,** assistant professor of geology, will meet the party in the Coeur d'Alene, and **F. B. Laney,** professor of geology, will travel with them as far as Kimberley.

OBITUARY

W. L. Douglass, Nevada mine operator, died recently at Tonopah of pneumonia.

Francis L. Bosqui, consulting metallurgical engineer, died on May 4, following a month's illness, at Johannesburg, South Africa, where he was engaged in consulting practice. Mr. Bosqui was internationally known in the mining profession, particularly for his achievements in developing the cyanide process in the United States and South Africa. An appreciation will appear in an early issue.

Digest of Current Literature

Bauxite. G. Malcolm Dyson. *Chemical Age,* Feb. 16, 1929; pp. 150-1. Geologically speaking, bauxite deposits are generally pisolitic, and apparently deposited as a semi-intrusion among other rocks. The mineral must usually be mined, but in some American deposits quarrying of outcrops is possible. How the water is held in bauxite is not yet entirely settled, but apparently most of it is combined. The temperature-dehydration curve shows one loss of water at about 250 deg. C., and another between 650 and 750 deg C. The latter corresponds to the dehydration temperature of gibbsite, which is probably a major constituent of bauxite. In addition to the normal form, which is the best quality, there is a white (siliceous) grade of bauxite, mostly used for making alum and refractories. There is also a red grade, used as a source of aluminum metal, and a titaniferous bauxite (found chiefly in India) from which titanium or its compounds can be profitably recovered. Bauxite deposits are always associated with clay. This is removed from the mineral by a process of peptization with alkali. For the subsequent chemical purification of the mineral only the Bayer process is widely used. The Serpek process is noteworthy, however, in that it combines fixation of atmospheric nitrogen (as aluminum nitride) with the bauxite purification. Bayer's process consists essentially in solubilizing the mineral by the action of caustic soda solution in an autoclave. The alumina which is obtained has many uses other than as a source of aluminum metal. Bauxite itself also has many uses, in making abrasives, refractories, "ciment fondu" and like products, in petroleum refining, and to a minor extent in other applications.

Conical Cartridges. H. Henkel. *Zeitschrift für das gesamte Schiess-und Sprengstoffwesen,* December, pp. 431-3; criticism by Peter Rauch, February, pp. 49-51. Increasing the disruptive effect of the explosive does not correspondingly increase the useful effect of a charge in mine blasting; the added energy is merely used up in shattering the walls of the straight, uniform borehole. By using a series of conical instead of cylindrical cartridges, the uniformity in shape and direction of the unoccupied space in the borehole is broken up, shattering of the wall is thereby facilitated, and the useful effect of the charge is increased. In the Henkel system, the conical cartridges are wrapped in a strong membrane of cellulose hydrate, water- and oil-proof. They can be stored and shipped without being paraffined. Diagrams are shown of several possible arrangements of the conical cartridges in a borehole. Rauch, in his criticism of the system, states that the development is as yet purely theoretical, and calls attention to some difficulties which may be expected in actual operation. Both in initial cost and in labor cost for inserting in the borehole, the conical cartridge would be more expensive than the cylindrical. The theoretical basis of the invention is questionable; and the safety, which is claimed to be greater than with cylindrical cartridges, may actually be somewhat less. A trial, under actual operating conditions, is needed to ascertain whether the invention has merit to justify its added cost.

Copper Matte Concentration. Otto Barth, *Metall und Erz,* Feb., 1st No., pp. 66-9. The origin of the process used in Mansfeld for concentrating crude copper matte dates back several centuries. Shaft furnaces were long used; then for some 75 years (about 1851 to 1926) the Mansfeld smelters used reverberatory furnaces. Economic considerations (furnace efficiencies, coal prices, freight rates) then led to the further improvement of effecting the concentration in converters. The favored type is a Krupp drum converter, 2.5 m. in diameter and 4.4 m. long, capable of concentrating about 70 tons per day of crude copper matte. In 1926 the costs, using the reverberatory furnace, were 7.50 marks for roasting and 20.50 marks for concentrating, a total of 28 marks per ton of ore. Present costs, using converters, are 7 marks for melting and 11 marks for the converter concentration, a total of 18 marks per ton of ore.

Corrosion. A. Matagrin. *L'Industrie Chimique,* Jan., pp. 12-5; Feb., pp. 73-5; March, pp. 127-9. The chemical theory of oxidation of metals can be reconciled with the newer colloidal theory; indeed, the two must be used together. The electro-chemical theory also has an essential place; among its consequences is the comparatively recent idea that chemical resistance of a metal can be increased by alloying it with an element which is a poorer conductor of electricity. This idea, exemplified in ferrosilicon and ferrochrome, is useful also in non-ferrous metallurgy, although no definite relation is yet known between the conductivity of an element and its effect on corrosion resistance. Corrosive attack on metals, as a problem affecting every kind of engineering activity, is progressing toward solution through metallurgy, in proper compounding of metals, rather than through other methods.

Schwarzwald Ores. H. Schneiderhöhn. *Metall und Erz,* first April number, pp. 161-6. The ore deposits of the southwest part of Schwarzwald have been worked for many centuries, the first historical record appearing in 1028 A.D. Probably the pre-Roman Celts also worked these mines. The main deposits occur in the large gneiss region, with lesser ones in the Devonian-Culmian rocks and in the massive granites. Münstertal porphyries apparently are not valuable as ore. The gneisses, occurring especially in the comparatively small Schauinsland area, are of three kinds—eruptive, sedimental, and injectional. Around Freiburg the eruptive gneisses are especially frequent. The ores and minerals found in the Schwarzwald region include fluorspar, blende, galena, calcite, heavy spar, quartz and other silica minerals, marcasite, pyrite, chalcopyrite, and some carbonates. These are classified according to their geological origin and formation. In general, the Schwarzwald ores and minerals may be said to constitute a unitary intrusive-hydrothermal metal domain, formed by the Culmian granite intrusions, probably at the beginning of the Permean age. Two charts (compiled from published and unpublished maps and literature) are given, one showing the geological formations of the region and the other the extent and approximate position of the principal ore and mineral deposits. A profile diagram, indicating the position of the important Schauinsland region, is also shown. Literature references are cited.

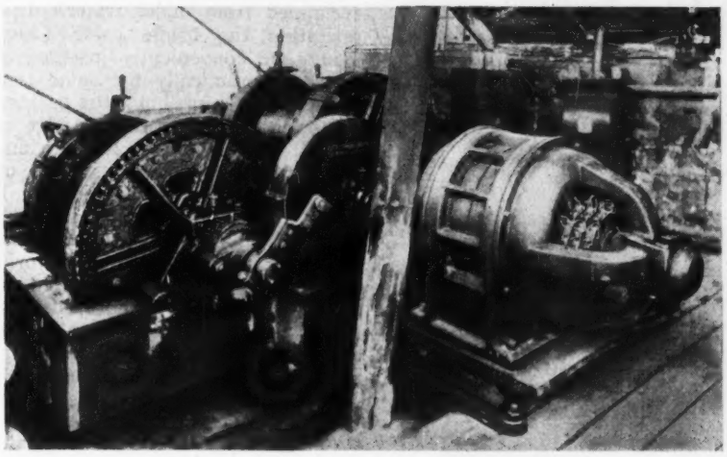
Respirators. *Zeitschrift für das gesamte Schiess- and Sprengstoffwesen,* March, pp. 113-4. A report of the status of gas mask equipment and protection for mine rescue work in Prussia. The Audos type masks (1926 and 1927 designs) are permitted for use of up to two hours' duration. Oxygen cylinders are required to be tested by the water-pressure method every five years, and are rejected if any corrosion loss or other defect is apparent. Tests indicate that the Degea mask, with large adsorbent cartridge, is effective against CO, dust, fumes, and smoke, but the mask is not yet accepted for the permitted list. Mine rescue stations are now being equipped with stationary set-ups for rapid testing of masks, instead of the former portable outfits.

Electrolytic Uses of Tantalum. Johannes Becker. *Chemische Fabrik,* Jan. 30, 1929; pp. 49-51. Since the metallurgy of tantalum advanced, some years ago, to the stage where the metal could be worked into a wide range of shapes and sizes, tantalum electrodes have found numerous applications. This is particularly true where corrosive conditions had previously necessitated the use of more expensive metals, such as platinum. But tantalum electrodes are also finding favor for the more prosaic uses of electrolytic precipitation of other metals. These electrodes are useful in recovering such metals as copper, cobalt, and nickel from acid baths, and for nickel from ammoniacal solution. For electrolyzing salts of zinc, a tantalum electrode does not need to be plated with gold or silver.

Gypsum. G. Malcolm Dyson. *Chemical Age,* March 16, pp. 252-3. Of the basic industrial minerals, gypsum in its various forms occupies an important place. Anhydrite occurs in four forms: compact, foliated, scaly, and cubic. Selenite is a large crystalline form of the hydrated sulphate; alabaster is a hard compact gypsum, and satin spar is one of the normal fibrous forms of the mineral. The United States and France lead as producers of commercial gypsum. Canada and the British Isles are next in quantity, but are much smaller producers.

Uraninite. Assar Hadding and Rene van Aubel. *Comptes rendus de l'Academie des Sciences,* March 4, pp. 716-7. The occurrence of uraninite in the Belgian Congo is interesting in that it is the parent mineral of the crypto-crystalline pitchblende which is the principal mineral of the Katanga radium ore deposits. Data from X-ray spectrographic studies of a sample of uraninite from the Belgian Congo are given in tabulated form. The mineral occurs in cubes and its X-ray crystal pattern is a center-faced cube.

INDUSTRIAL PROGRESS



Lidgerwood hoist operated by 75-hp. slip-ring motor and drum control

Selecting the Most Advantageous Drive for Slack-line Excavators

By R. F. Emerson
Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

THE slack-line cableway excavator provides a moderate-priced machine of fairly long reach. It is successfully used under many conditions where the steam shovel and revolving derrick are impracticable because their reach is virtually limited to the length of the boom. The essential parts of a slack-line cableway excavator consist of the following:

1. Mast—This is a vertical structural steel tower as shown in Fig. 1. It is pivoted at the bottom so that it may turn from time to time as the work progresses.

2. Track cable—Usually the outer end of the track cable is fastened to another cable stretched between a couple of "dead men" several hundred feet from the base of the mast, as shown in Fig. 1. This method of fastening the cable provides a convenient method of moving it to new ground as the scraper clears away the material. The mast end is fastened to a tail block near the top of the mast. This track cable is tightened when the scraper bucket ascends or descends and is slacked off when the bucket is digging a load.

In some operations the outer end of the track cable is fastened to a low tower, which is moved radially on skids or a trackway.

3. Tension cable—This cable is used only for slacking off and tightening up on the track cable. The track cable must be pulled very tight, so that the final grade may not be too steep when hauling in a loaded bucket. For this reason, something like a five-part line at the masthead, as shown in Fig. 1, is necessary in order to get enough tension on the track cable.

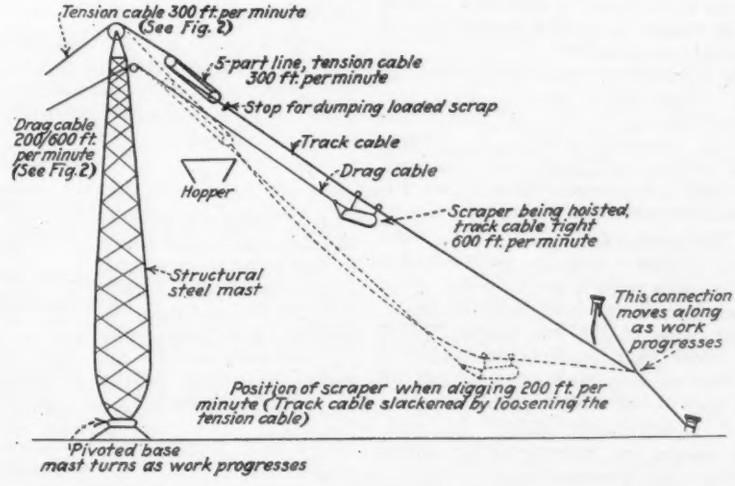
4. Drag cable—This runs from one of the drums on the hoisting engine through a pulley at the top of the mast to the "bridle" on the front end of the bucket. This cable pulls the bucket through the gravel at low speed when digging a load, and, after the main cable is tightened, it pulls the bucket up to the masthead at approximately three times the dipping speed, and then the load is dumped into a hopper. The drag cable drum is then unclutched to allow the bucket to coast back to the digging point under control of a brake.

5. Bucket or scoop—In shape, this device resembles a large shovel or scoop minus the handle. The drag line is attached to a bridle at the front end. It is supported by small trolley wheels which ride on the track cable. (Fig. 1.) When the bucket is near the masthead, it strikes a stop (either fixed or movable) on the track cables, which causes the load to be dumped into the hopper. One method of dumping, used by several manufacturers, accomplishes the purpose by lifting the rear end of the bucket, the material spilling out of the front end. Another method uses an arm projecting in front of the bucket, which hits a stop at the dumping point, causing the back end of the bucket to open and the materials to slide out.

The Hoisting Engine

The essential parts of this equipment consist of two drums driven by a steam engine or a motor (gasoline or electric), clutching and unclutching the drums being possible (Fig. 2). This discussion, however, deals only with the operation of the electric motor.

Fig. 1—Diagram of the component parts of the slack-line cableway excavator. See Fig. 2 for the hoisting engine.


Tension cable 300 ft per minute (See Fig. 2)
5-part line, tension cable 300 ft per minute
Stop for dumping loaded scrap
Drag cable 200/600 ft. per minute (See Fig. 2)
Track cable
Drag cable
Hopper
Scraper being hoisted, track cable tight 600 ft. per minute
Structural steel mast
This connection moves along as work progresses
Position of scraper when digging 200 ft per minute (Track cable slackened by loosening the tension cable)
Pivoted base mast turns as work progresses

Lidgerwood drag-line scraper operating under unusually severe conditions where the bucket sometimes snubbed against a submerged stump or boulder

The control was adjusted so that the motor automatically slowed down as the torque approached the breakdown point of the motor. Before this was done, the drag cable was broken several times when the bucket stalled the motor by butting into an obstruction too large for the scraper to handle.

Some hoisting engines are designed to be driven from the motor by silent chain and others by gears. The two drums are arranged in tandem; that is, one is back of the other, as shown in Fig. 2. These free revolving drums are put into operation by means of friction clutches. One drum is used entirely for tightening the track cable by hauling in on the tension cable. The other drum is arranged for two speeds. These may be obtained either mechanically by gear shift or by the use of a two-speed induction motor. Experience has shown that about 3-to-1 speed reduction is best. The low speed is for pulling the bucket through the gravel for digging, and the high speed is used for getting the full bucket up to the dumping point as quickly as possible.

The advantages and disadvantages of using single-speed motors with mechanical gear shift for two-speed operation, as compared with using a two-speed motor, will now be discussed. The chief advantages claimed for the multi-speed motor drive are as follows:

1. The mechanical part of the power unit is simpler. A pinion on the motor shaft meshes with a gear on the drive shaft. The drive shaft has two gears, one for each of the two drums. This gives three gear contacts as against a minimum of four such contacts on the other type of two-speed hoist.

2. A squirrel-cage motor is used, which means an absence of all motor slip rings and brushes.

3. Changing motor speed requires the handling of a light master-switch handle, which requires a minimum of physical exertion on the part of the operator.

Some possible disadvantages are:

1. Unless the control is carefully laid out with proper resistances, a shock or strain on the equipment will occur when changing speeds. In all fairness to this arrangement one should state that this difficulty can be overcome if the electrical manufacturer is advised of the loads, speeds, and mechanical efficiencies of any particular application, so that the resistors can be correctly laid out to correspond to the speed torque characteristics of the two-speed induction motor.

2. This system is somewhat inflexible, since both drums must run at either the low speed or the high speed at the same time. This is easily realized when it is known that the motor is geared through the drive shaft to both drums and both drums must run in "high" or in "low" at the same time. Therefore, to pull the loaded bucket up to the dumping place on high speed, and at the same time tighten the track cable at the low speed, is impossible. An example of this difficulty follows:

Sometimes sand or gravel must be reclaimed from under water. In such operation the bridle cable (Fig. 1) cannot be conveniently installed under water at practically the same level as the digging point, but must be installed on the bank or near the far edge of the pit. This means that a large amount of track cable must be slacked off to lower the bucket to the digging level. After the bucket is loaded it should be hoisted at high speed to the dumping point, but in this case the motor must haul the bucket at low speed for a large part of the distance, because of the large amount of track cable that must be tightened. To try to tighten the cable with the motor on the high-speed winding would seriously overload or stall the motor.

On account of the large proportion of low-speed running under these conditions, the motor gets considerably less cooling effect and may overheat dangerously. Under such conditions the additional complication of using forced-draft ventilation may be required, which means the installation of a small motor-driven fan.

Of course, for usual conditions of digging where the cable can be anchored somewhere near the digging level, less track cable need be laid out, and the proportion of low-speed running, with consequent overheating of the motor, is not so great.

The advantages claimed for single-motor drive over the two-speed motor arrangement may be summarized as follows:

1. Faster digging can be accomplished through the greater flexibility obtainable in being able to change from low speed to high speed on the front drum immediately after the digging operation is completed. This is in contradistinction to the disadvantage mentioned in item No. 2 of the two-speed motor rig in operations where a great deal of track cable must be paid out.

In other words, tightening the track cable can be continued with the rear drum at low speed and high torque, and the speed may be changed to high on the

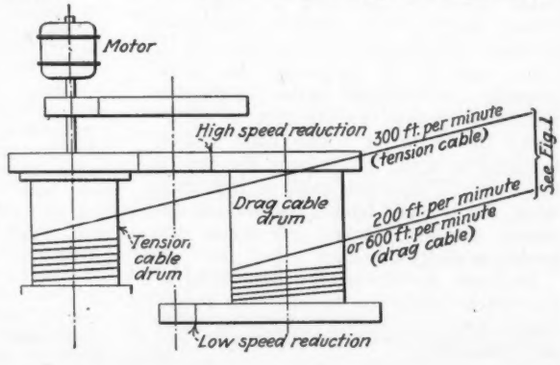


Fig. 2—Diagram indicating hoisting engine using wound-rotor, single-speed, induction motor. Either high or low speed is obtainable on the drag cable by gear shift without affecting the speed of the tension cable.

front drum by shifting gears, thus bringing the loaded bucket to the dumping point in the minimum time.

2. The first cost and the upkeep of the control will be less than when using a two-speed squirrel-cage motor. Inasmuch as the motor can run continuously as long as any digging is to be done, a drum controller and magnetic switch may be used, and a suitable resistor for all motor sizes.

3. Inasmuch as the the motor runs continuously at its normal speed, no overheating on account of reduced windage from excessive part-speed running can take place.

4. In exceptional cases where digging is done and where the bucket may hit hidden boulders or stumps, the shock or strain may be reduced by using a permanent resistor, with the proper amount of resistance in the motor secondary to give a sloping speed torque characteristic. The pull-out torque of the motor then occurs at a lower speed than that where no permanent resistor is used, and the energy expended is reduced as the square of the speed. That is, if the speed is reduced one-half before the motor stalls, the energy to be expended will be only one-quarter. The chance of the cables breaking or pulling the tower over when the bucket stalls the motor will also be much less. The permanent resistance, being external to the motor, will not heat up the motor windings, as would be the condition when using a high-resistance rotor in a two-speed squirrel-cage motor.

Disadvantages of this type of rig are:

1. The presence of slip rings and brushes means additional upkeep as compared with a squirrel-cage motor.

2. Operating the equipment requires more physical exertion on the part of the operator, as the motor runs continuously and speed change is obtained entirely by operating mechanical levers on the hoisting engine itself.

The two schemes of electric drive described in the foregoing are the most popular. A third method involves using two slip-ring induction motors connected one on each end of a shaft with a pinion on the center of the shaft. The two drums are geared to the pinion. One motor has a speed of three times the other, to obtain the necessary speed variation. The drums can be clutched or unclutched to their respective gears by friction clutches. This scheme has the advantage of using only two gear contacts. It is complicated in that it uses two motors; but only one control is necessary, because only one motor runs at a time. It has the same objection of inflexibility as given in the foregoing for the double-speed motor rig, because, when both drums are running, they must both run on either high or low speed. This scheme does not provide for hoisting the bucket at high speed and at the same time tightening the track cable on low speed, as can be done when using a single-speed motor with mechanical gear change.

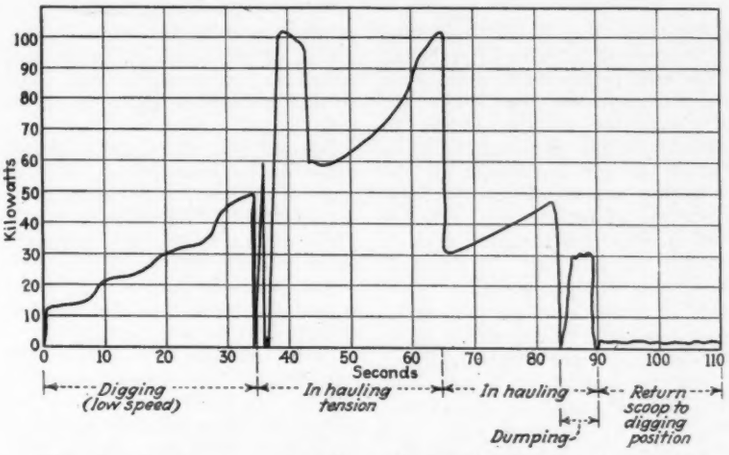


Fig. 3 — Load curve of a 2 cu.yd. bucket digging in gravel using a 90-hp. wound-rotor motor

BULLETINS

AUTOMATIC VALVES—The Bristol Company, Waterbury, Conn., Catalog No. 2,000, automatic electric control valves motor operated and magnet types. Twenty pages.

BLOWERS—Elliott Company, Jeannette, Pa. Bulletins No. P-2 and 3, turbine driven and motor driven type "O" blowers. Four pages each.

ELECTRIC HAULAGE—General Electric Company, Schenectady, N. Y. Bulletin GEA-961A, helicoil (sheath wire) resistor units for cable-reel motors. Two pages.

CRUSHER—Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Bulletin No. 1,469, Style "B" Newhouse Crusher. Twelve pages.

WATER TREATMENT—Graver Corporation, East Chicago, Ind. Bulletin No. 5,049, Graver hot process water softener. Fifteen pages.

MAGNETIC SEPARATION—Magnetic Manufacturing Company, Milwaukee, Wis. Bulletin No. 80, magnetic separation equipment for the concentration of ores and minerals.

STOKER—Combustion Engineering Corporation, International Combustion Building, 200 Madison Ave., New York City. Descriptive booklet MR-1, the C-E multiple retort underfeed stoker. Fifteen pages.

PATENTS

REAGENT FEEDER. No. 1,709,987. April 23, 1929. M. Kraut, San Francisco, Calif.
Design for a reagent feeder.

PURIFICATION OF METALS. No. 1,709,939. April 23, 1929. E. R. Hewitt, Midvale, N. J.
A centrifugal apparatus for the separation of foreign matter from molten metal.

PNEUMATIC TABLE. No. 1,710,521. April 23, 1929. H. M. Sutton, W. L. Steele, and E. G. Steele, Dallas, Tex.
Design for a pneumatic concentrating table.

SMELTING ZINC ORES. No 1,709,135 April 16, 1929. R. L. Lloyd, assignor to Dwight & Lloyd Metallurgical Company, New York, N. Y.
A receptacle for use in smelting zinc ores, the composition of which consists principally of zinc oxide bonded with a sulphate of zinc.

HYDRAULIC CLASSIFIER. No. 1,709,365. April 16, 1929. J. F. Newsom, Palo Alto, Calif.
Design for a hydraulic classifier of the box type, and in which a horizontal stream of water is introduced below the level of the contents of the classifier and the point where the pulp enters it.

Rock Drills

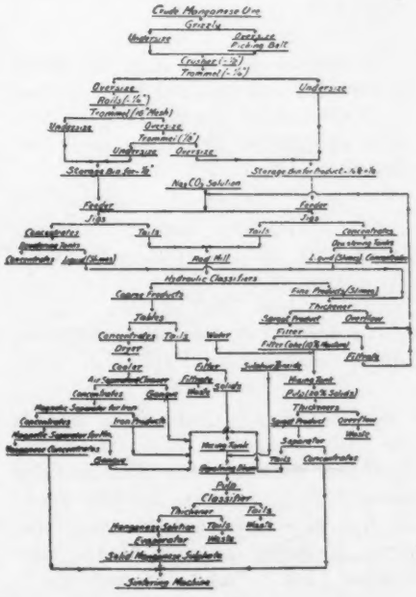
Nos. 1,708,975-6. April 16, 1929. A. H. Skaer and A. H. Katterjohn, assignors to The Gardner-Denver Company, Quincy, Ill.

No. 1,709,024. April 16, 1929. A. H. Katterjohn, assignor to The Gardner-Denver Company, Quincy, Ill.

No. 1,709,440. April 16, 1929. C. F. Osgood, assignor to Sullivan Machinery Company, Chicago, Ill.
Designs for drilling machanisms.

No. 1,709,407. April 16, 1929. L. L. Richardson, assignor to The Cleveland Rock Drill Company, Cleveland, Ohio.
Design for a drill-steel retainer.

CONCENTRATING MANGANESE. No. 1,710,522. April 23, 1929. H. Trumbo and A. J. Trumbo, assignors to Manganese Patents Corporation, Nev.
A gravity method of concentration in which the manganese ore is first subjected to the action of a cleaning solution.



NEWS OF THE WEEK

Summary

NO. 4 shaft at Noranda Mines is down 850 ft. and will reach its objective soon. Increases in smelter capacity will depend largely on amount that can be handled by the eight roasters. Page 773.

* * *

Development of the Ardsley district of Montana has taken place within the last two years. Several mines are already producing. Silver ore predominates, but copper showings are increasing at depth. Page 771.

* * *

Production will start soon from the Wenden mine, near Wenden, Ariz., according to a letter sent out by the president. High-grade ore will be shipped direct to smelter. Page 770.

* * *

A report has been issued on diamond-drilling results obtained on the property of Chibougamau Prospectors, in northern Quebec. Copper and gold were found over good widths. Page 774.

* * *

For the last four months not a single lost-time accident has been recorded at the Morenci branch of Phelps Dodge Corporation. Copper Queen had no accidents in March. Page 772.

* * *

A commission has been appointed to consider mining laws now existing in Mexico, and particularly to consider complaints by operators in this direction. Page 775.

* * *

The Tri-State district is again faced with the necessity of curtailing output of concentrate, as demand for zinc and lead lessens. Commerce Mining & Royalty is adopting the five-day week. Page 773.

* * *

Ground has already been broken for two important projects in the Sudbury district—the Falconbridge nickel-copper smelter on the shore of Boucher Lake and the new Ontario Refining copper plant, near Copper Cliff. Pages 773 and 774.

New Tariff Bill Fails to Alter Rate on Manganese—Non-Metallics Raised

By Paul Wooton

Special Washington Correspondent

WASHINGTON, May 7, 1929.—Despite all the arguments advanced on behalf of the domestic producers of manganese ore and concentrates, the Ways and Means Committee of the House of Representatives has declined to make any change in the paragraph of the tariff covering that metal. An increase of 5c. per pound on metallic tungsten contained in imported tungsten ores or concentrates was allowed. As changed, the rate is now 50c. per pound.

A duty of 8 per cent ad valorem is carried on steel or iron containing more than one-tenth of 1 per cent vanadium; more than two-tenths of 1 per cent tungsten, molybdenum, or chromium; and more than six-tenths of 1 per cent of nickel, cobalt, or any other metallic element used in the alloying of steel or iron. Phosphorus, manganese, and silicon will not be considered as alloying materials unless they are present in the steel in excess of 1 per cent, or unless they are present in iron in excess of 3 per cent. An additional cumulative duty of $1 per pound of vanadium content in excess of one-tenth of 1 per cent is provided in the new bill, as is a duty of $0.72 per pound on the tungsten content in excess of two-tenths of 1 per cent. On the molybdenum content $0.65 per pound is levied when it is in excess of two-tenths of 1 per cent. On chromium the duty is $0.04 per pound for content in excess of two-tenths of 1 per cent.

Flue dust was incorporated in the lead-ore paragraph, which was amended to provide that the duty of 1½c. per pound on lead is not to be applied to the non-recoverable lead contained in copper, gold, or silver ores, or in copper matte. A similar provision in the zinc paragraph covers non-recoverable zinc. This is in line with the representations of the smelting industry that it is not equitable to tax that which cannot be sold. The zinc paragraph was amended further to include zinc dross and zinc skimmings with zinc fit only to be remanufactured. The duty applying on this classification is 1½c. per pound.

The pig iron schedule was advanced from $0.75 per pound to $1.12½ per pound to conform with the President's proclamation under the flexible provision of the tariff. Sponge iron was added to the wrought iron paragraph so that it could be given an ad valorem rate.

Several new alloys are mentioned by name or by description. The phraseology of the new bill is expanded to meet the advances being made in metallurgy. This applies to the non-ferrous alloys more than the ferrous alloys.

An additional duty of 1.3c. per pound is assessed for hollow drill steel valued at more than 4c. per pound.

Crude feldspar was taken from the free list by the committee and made dutiable at $1.50 per ton. The committee also proposes that fluorspar, now dutiable at $5.60 per ton, be increased to $8.40 per ton. An increase of 5 per cent in the ad valorem rate applying to talc, steatite, and French chalk is also proposed, thus making the rate 30 per cent. The bill carries a 25 per cent ad valorem rate on crystalline lump, chip, or dust graphite, representing an increase of 5 per cent. On crystalline flake, the specific duty is reduced from 1½c. per pound to 1¼c. per pound.

Wenden Copper to Start Producing Before July 1

BEFORE July 1, Wenden Copper will start production from its mines in Cunningham Pass, via Wenden, Yuma County, Ariz., according to Ned Creighton, president of the company, in a letter to stockholders. For the next quarter, the high-grade ore on the 1,000 level will be hoisted through the Barkdoll shaft and shipped directly to the smelter. Ore not sufficiently high in grade to ship will be stored for mill treatment. As operations progress, additional stopes will be opened on the 700 level.

Installation of new mine machinery incidental to the electrification of the mine plant has progressed satisfactorily. When in operation, power will be available sufficient to handle 500 tons daily, but the initial operations will be materially less than this maximum.

Ardsley Section of Butte District Was Developed Within the Last Two Years

Several Small Companies Now Producing or Developing in Southwest Part of the District—Silver Predominating Metal in the Ore—Greatest Depth to Date Is Only 510 Ft.

By Carl J. Trauerman
Special Montana Correspondent

During the last two years, a practically new section has been developed in the famous Butte district of Montana. It is known as the Ardsley section, and lies west and southwest of Butte Hill, and west of the old town of Williamsburg. In the accompanying map, this section and the section immediately contiguous to it are shown. The Ardsley section is that portion lying south of Silver Bow Creek.

Several years ago, high-grade silver ores were extracted from the Isele and Olive Branch claims, but work was continued only to a comparatively shallow depth. The early operators did not have the capital to handle the flow of water at depth, and when zinc ores were encountered, the smelter penalty then obtaining prevented profitable operation. As a result the properties were closed, and practically no work was done until early in 1927, when Ardsley Butte Mines Corporation started work on the Highland group.

Reno H. Sales, chief geologist of Anaconda Copper, considers this district in the so-called "peripheral" area, and in a paper read at the Butte meeting of the A.I.M.E. in 1913 said, "As with the central and intermediate zones, the line of division between the intermediate and the outer zones is largely an arbitrary one. It marks the general outside limit of present known commercial copper deposits, and therefore it is in no wise intended to be construed as an attempt to mark the possible limit of copper ores. Up to the present time the ores of this zone have been valuable principally for silver, gold, and zinc. The vein filling is characterized by the abundance of the manganese minerals rhodochrosite and rhodonite. Sphalerite is present in great abundance, forming in some instances orebodies of value. Copper is sparingly present, chiefly as chalcopyrite, tetrahedrite, tennantite, and rarely chalcocite and bornite. Pyrite is common, but in relatively much less quantities than in the central and intermediate zones. Quartz is the most abundant gangue mineral. Galena is also present in considerable quantities intimately associated with sphalerite and of the same age. The width of this zone is indefinite and irregular, and there is a noticeable change in the mineralogical character of the vein filling at greater distances from the central copper zone."

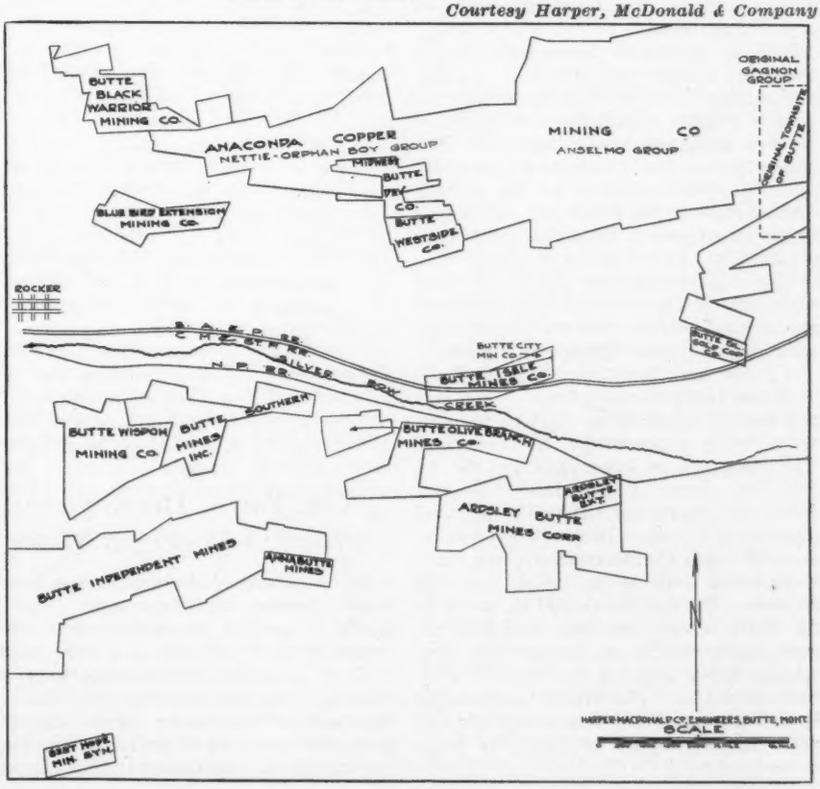
This report was written in 1913, when the deepest development in the Ardsley section was about 400 ft. and when not much lateral development had been done. With the further development of this district in depth and laterally it is possible that new geological data will be encountered which will bring this district inside the true "peripheral" area.

Ardsley Butte Mines Corporation started in 1927 by opening a shaft on the Agnes claim. The Agnes vein down to the 150 level was not very wide and did not show extraordinary values, so the working base was changed to the Highland shaft, which has now been sunk to a depth of 510 ft. The first station was cut at the 365 level, and the vein drifted on to the west for a distance of about 60 ft. Here a fairly large body of high- and medium-grade silver ore was opened, the vein being mined at points as wide as 30 ft. The orebody, with the exception of a break of 120 ft., which contains milling ore, had a length on the 365 level of over 900 ft., and good ore is still found in the west face. Two other veins also were opened on the 365 level, a winze was sunk to the 455 point, and the 250 level opened and drifted on to the east and west of the shaft.

The No. 5 level recently was opened, and in the south vein shows copper and silver ore. Copper content on this level is greater than at any other point in the mine. The company is now building a "rougher" mill to handle 150 tons of low-grade ore daily and is shipping about one car per day of high-grade silver ore to the Timber Butte mill of Anaconda Copper. The property is being managed by L. O. Goodman and R. H. Sawyer, and control of the company lies in the open market. Although the property is still in the development stage, it produced in 1928 approximately 17,599 tons of ore, from which it received $182,513.42 net from the mill. Actual profits were $111,113.52 before federal taxes, depletion and depreciation. The accompanying illustration shows the Highland shaft headframe and surface buildings in the foreground and in the background the city of Butte and Butte Hill. The mountains in the background are the backbone of the Continental divide. Immediately behind the headframe are the Northern Pacific & Butte and Anaconda & Pacific railroads and the bridges to the right are the Butte entries of the Chicago, Milwaukee, St. Paul & Pacific Railway.

To the east of Ardsley Butte is Ardsley Butte Extension Mining, which owns the Gold Stream claim, on which is situated the town of Williamsburg. The property is opened to the 250 level, where the company is working on two veins. Shipments are averaging better than one car of silver ore per day. The initial financing of the company was done in Butte, but arrangements have been made for Eastern financing.

Map showing locations of the various companies in the Ardsley section of the Butte district, Montana
Courtesy Harper, McDonald & Company



Surface plant at the Highland mine of Ardsley Butte Mines Corporation

to enable sinking the shaft to 1,000 ft. The property is managed by James LaFountain and John A. Roos.

North of the Ardsley Butte is the Olive Branch group, controlled by M. D. Kelly, of Milwaukee and Chicago; W. C. Siderfin, formerly with the W. A. Clark interests; Fred Melcher, Butte business man and manufacturer of mining machinery; and others. The property is opened by a shaft 220 ft. deep, which recently has been unwatered. Ore was encountered at the bottom. It shows zinc and silver. Former production was a little more than $200,000. The property is equipped with modern electrically driven machinery, and the shaft will be sunk deeper. Financing was done in the East and in Butte.

North of the Butte Olive Branch group is Butte & Isele Consolidated Mines, which also recently purchased the claim owned by the Best Hope Syndicate shown at the bottom left of the map. The company is controlled and managed by Hildegarde Kelley and John Cudahy. Recently installation of surface buildings was completed. The company has partly unwatered its shaft, which is 400 ft. deep. Ore has already been opened on the 100 level. According to the management shipments will begin about May 15. The property is said to have a production record of over $1,000,000. The main surface buildings are only a few feet from the paved highway running from Butte to Anaconda.

To the southwest of Ardsley Butte is Butte Independent group. This was the second company to start in the district, being financed by Butte capital. The property is controlled by W. C. Siderfin, James LaFountain, John A. Roos, Al Hultman, John Wulf, and Thomas P. Cates. It is opened by the Ironsides and Canadian shafts, the main work being done in the latter, now 325 ft. deep. On that level, 400 ft. north of the shaft, a vein has been encountered, now being drifted on to the east, and which shows about 1 ft. of solid lead-zinc sulphides. The Butte Independent is well equipped for deep work and expects to thoroughly prospect its large properties.

West of the Olive Branch are the Butte Southern Mines, Inc., and the Butte Wisdom Mining Company. The formation on the grounds of these two companies shows heavier mineralization on the surface than on the other properties in the district, Butte Southern showing high-grade copper ore at grass roots. This company controls the Metz group, and was organized by Colonel A. P. Peake, organizer of the Butte & Superior Mining. It is controlled by Colonel Peake, Harry T. Lewis, formerly of the assay firm of Lewis & Walker; Ernest Dorais; and J. J. Davis. Initial financing was done locally, but the main part of the financing has been arranged for in Eastern financial centers. The property shows both an east-west and north-south vein system, these veins being opened by tunnels at several points on the surface. The main opening is a 110-ft. shaft on the Virgo claim. This has been unwatered, retimbered and enlarged to the 60-ft. point. The property is equipped with modern machinery capable of sinking to 1,500 ft. The management plans to sink the shaft immediately.

Butte Wisdom Mining is directly west of Butte Southern. It has good surface showings, but has not been developed at depth. It was financed by residents of Butte and Wisdom, headed by Tom Woods and W. P. Jahnke. The property is being equipped for further prospecting.

Anna Butte Mines, southeast of Butte Independent, was organized by Al Fischer and Ray Tower, of Butte. It has equipped its shaft and is now down 150 ft., where a vein is being followed.

New Power Development May Aid Michigan Mines

Development of the Ontonagon River water power, in Ontonagon County, Mich., a project on which much preliminary work already has been done, will be a source of encouragement to mining companies owning properties in that part of the district. It is a remote area, and the cost of fuel is a big item on account of expense of transportation.

No Lost-Time Accidents at Morenci for Four Months

ADDITIONAL records fell by the wayside in the continuous safety contest among the five branches of the Phelps Dodge Corporation during March, when employees of the Morenci unit worked their fourth consecutive month without a lost-time accident and the Copper Queen branch hung up its first perfect safety score sheet for a month's period by tying the Morenci group without a single lost-time accident in any department. Only five lost-time accidents were chalked up against the five branches for the entire month. This is the lowest accident figure for the branches since the contest was launched, and indicates the success of the safety movement of the corporation. The Moctezuma branch, of Nacozari, Mexico, was in second place for March, with only two accidents, ranking above Old Dominion, of Globe, which had only one accident, because of a greater number of employees. The Stag Canon branch was in last place, with only two lost-time accidents. Figured on the basis of 1,000 shifts worked, the rating of the Moctezuma branch for March was 0.038; that of the Old Dominion 0.045; and that of the Stag Canon, 0.108.

Morenci branch, with a perfect score for January, February, and March, leads in the year to date. Moctezuma branch with a percentage of 0.020, figured on the basis of 1,000 shifts worked, is in second place; Copper Queen, with a percentage of 0.038, is in third place; Old Dominion, 0.107, fourth, and the Stag Canon, 0.113, fifth. Three of the five accidents recorded against the different branches during March occurred in the underground mining department. The two accidents recorded against the Stag Canon unit occurred in this division and also the one chalked against the Old Dominion. One of the two lost-time accidents against the Moctezuma occurred in the mechanical, power, and all-shops department, and the other in the miscellaneous surface department.

Only those accidents are included under lost-time in which the injured man is forced to leave the shift.

Welding Company Acquires Arizona Tungsten Mine

A tungsten deposit in Arizona has been secured by the Stoody Company, manufacturers of alloy metal welding rods and welding materials, of Whittier, Calif. The company has already contracted for $50,000 worth of mining and milling machinery to be installed at the mine property. Final refining will be done at the company's plant at Whittier. The Stoody Company uses large quantities of tungsten, which has heretofore been imported. Owing to the increase in duty on tungsten, the development of domestic sources of supply became an important matter. The deposit is located near Tucca.

No. 4 Shaft Nears Objective at Noranda Mine

THE No. 4 shaft of the Noranda is now down 850 ft. at the property in the Rouyn district. It will be continued to 1,000 and at the 975 level will be connected with the No. 3 shaft. When this connection is made, a decision will become possible as to whether or not both shafts will be deepened to 1,250 or 1,500 ft. during the present year. The smelter is treating 1,200 to 1,300 tons a day and in September, with both furnaces operating, the capacity will probably be 2,000 tons. Tonnage to be treated will depend largely upon the capacity of the roasters. When the original plant was designed for a capacity of 1,000 tons a day eight roasters were installed. It was finally found that the work could be done with six and at the present time five only are being used for the 1,200 tons a day.

Mine developments have been such that with the completion of the enlarged plant another step-up in capacity is expected. Last year an increase of $52,000,000 gross in the ore reserves was noted, and since the end of the year further material additions have been made. Recently the C orebody was cut at the 725 level and showed ore running 7 to 8 per cent copper, in addition to gold. The concentrator has again been started and is treating 150 tons daily and giving a high-grade concentrate. A large amount of building and construction is being done: new compressors and new convertors are on order, and all preparations point to greatly enlarged tonnage and profits.

During April the Waite property, controlled by Noranda, shipped 5,000 tons to the Horne smelter.

On the Newbec property, in which Noranda officials are also interested, developments have been more encouraging. On the 125 level the second lens of ore has been cut. It shows 7½ ft. of 13 per cent copper.

Tri-State District Again Curtailing Its Output

MINES of the Tri-State district are faced with the necessity of another period of curtailment if the demand for concentrates the past few weeks be any criterion. That the need for a reduction in output is obvious has brought about an announcement from Commerce Mining & Royalty, the largest producer in the field, that it will close some of its mines and place the remainder on a five-day-week basis, thereby reducing output from approximately 1,500 tons to 1,000 tons of concentrate a week.

A majority of the major producers of the field are aware of the necessity of curtailment to hold the present $44 price for concentrates, and are expected to follow the lead of the Commerce company.

Complete co-operation will be somewhat difficult to obtain, as many of the mines operating now have just recently been reopened and the owners are reluctant to close them after only a few weeks of operation.

Production in the field has been about 15,000 wet tons a week for the last three weeks, and the apparent consumption is around 13,000 tons. A slightly larger demand for concentrates may materialize before the end of the summer. Smelters have been doing an excellent business, and anticipate a greater demand for metal before many months.

Ground Broken for Falconbridge Smelter

GROUND was recently broken and orders were placed in connection with construction of the first unit of the proposed nickel-copper smelter of Falconbridge Nickel Mines, Ltd., in the Sudbury district of Ontario. The smelter site is on the shore of Boucher Lake, about 2,100 ft. west of the shaft. A rope tramway will connect the shaft with the smelter.

The first unit will consist of a 225-ton blast furnace, and two rotary converters, 13x20 ft. each. Orders for both furnace and converters have been placed with Canadian Allis-Chalmers, Ltd., for delivery within four and a half months.

Falconbridge operations will employ about 200 men during the summer.

Two Lose Lives When Riverside Mill Burns

TWO MEN lost their lives and eleven miners were temporarily trapped in the mine of the Riverside Mining Company's property, 6 miles southwest of Joplin, Mo., on April 30, as a result of a fire which completely destroyed the $75,000 concentrator.

Francis Lewis, nineteen-year-old Baxter Springs boy, a screen hand, was killed instantly when he leaped from the derrick window, 50 ft. from the ground. Jackson Woods, hoisterman, trapped in the derrick with Lewis, died soon after being taken to a hospital, following his leap from the burning derrick. The eleven men in the mine were trapped for about six hours while firemen extinguished the blaze about the collar of the shaft. A winch, placed on a truck, was used to bring the men to the surface. An upcast shaft probably aided materially in keeping the toll of life to two; otherwise the men trapped in the ground might have perished.

The fire started in the engine room, evidently from an oil-soaked floor, and spread rapidly through the mill and to the derrick and hopper.

New Minnesota Laws Lighten Iron-Ore Tax Burden

ON APRIL 24 the Minnesota Legislature adjourned after passing two bills that offer some relief to the iron-ore mining industry from its heavy burden of state taxation. The per capita tax limitation, passed in 1921, was amended so that the former limit of $100 per capita for municipal purposes will be reduced to $80 per capita in 1930; $75 in 1932; and $70 in 1933 and thereafter. A companion law to the per capita tax reduction measure was passed known as the "cash basis" plan. It will enable iron-ore range municipalities to retire outstanding indebtedness systematically and will prevent the accumulation of future indebtedness, so that eventually a "pay as you go" policy will be in operation. This law forbids issuance of certificates of indebtedness in anticipation of tax revenues to be received and provides for their retirement as soon as the funds are available.

Four bills that were proposed by the producers were lost at this session. These proposed that the tax on the occupation of iron mining be reduced from 6 to 4 per cent, that the tax on iron-ore royalties likewise be reduced from 6 to 4 per cent, that the iron-ore royalty tax law be repealed, and that the iron-ore occupation tax be suspended for four years. The mining companies had also originally asked that the per capita municipal tax limit be reduced from $100 to $60 immediately.

Lode Tin Mine in Japan to Increase Production

REPORTS from Toyo Mines, Ltd., a subsidiary of London Tin Syndicate, indicate rapid progress in development of the Mitate mine, in Japan. With completion of the new pilot mill, the mine now has a production of 50 tons of tin monthly, and is said to be paying all operating expenses. This progress has been made since the company was organized in November, 1927.

Machinery now being installed is planned to increase the output of the company to 6,000 tons of ore monthly. The company owns by direct title from the Japanese government 1,020 acres of land in the Island of Kyushiu. The reserve of ore in sight at present is 175,000 tons, with 290,000 tons probable.

Snowstorm Ships to Utah

Shipments from the Snowstorm mine, 7 miles northeast of Battle Mountain, Nev., are being made to the Midvale smelter of U. S. Smelting Refining & Mining, in Utah. Two carloads that have already been shipped netted $2,909 and $2,633, and an additional carload has been sent, from which returns are not yet available. Ore is carbonate silver-lead, occurring as a replacement of the limestone. Mining is conducted through a 200-ft. incline shaft.

Copper Range Installs New Hoist at No. 4 Champion

COPPER RANGE is installing a Nordberg hoist at the No. 4 shaft of the Champion mine, in the Michigan copper district. The hoist can operate to a depth of 5,000 ft. No. 4 is the richest unit of the Champion mine. The old hoist, which had reached its capacity in depth, will be left intact and later may be used as a timber and supply hoist or as an auxiliary, should it be found necessary to increase hoisting capacity by addition of another compartment. The No. 4 shaft is now down about 3,500 ft., as the result of 284 ft. of shaft sinking undertaken in 1928.

Report on Chibougamau Mine Indicates Possibilities

RESULTS of diamond-drill prospecting on one of the properties of Chibougamau Prospectors, Ltd., have just been published in a report by J. G. Ross, consulting engineer for Milton, Hersey & Company, of Montreal. In drilling through the ice on Lake Dore, in the Chibougamau Lake district of northern Quebec, ore was encountered in two holes. No. 1 hole showed 15 ft. of ore at a depth of about 180 ft. True width is calculated at 13 ft., and assays are reported to have yielded an average of 3.45 per cent copper and $2.36 in gold. No. 2 hole struck ore at a depth of 251½ ft., and for a total width of 76½ ft. yielded reported average assays of 2.4 per cent copper and $9.57 in gold. A portion of the core, about 30 ft., is said to have shown 3.2 per cent copper and $13.59 in gold. True width of the entire body is calculated as 41 ft., and of the richer 30-ft. section at about 17 ft.

Chibougamau Prospectors holds a total of 6,000 acres in twelve groups in the Chibougamau Lake district, which has been known since 1904. It is about 125 miles north of Oskalaneo, the nearest railroad station, on the Canadian National. At present supplies and equipment are transported from Oskalaneo by canoes in summer and dog teams in winter. The two diamond drills now working on the Chibougamau Prospectors' claims were taken to the camp by airplane from Oskalaneo. Airplane service is also being maintained from St. Felicien, on Lake St. John. The Quebec & Chibougamau Railway, financed principally by English interests, is under construction from Bolbeau, on the Mistissini River. Assurance that the railroad will be continued into the new camp is reported to have been made.

Jackson Mine to Reopen

Operations will be resumed at the Jackson Mountain property, near Winnemucca, Nev., under the direction of C. L. Crowder. The company will develop copper showings on the property, which consists of twenty claims.

Copper Fishing Now in Vogue Near Long Island

A HUNT for the steamer "Winceco," on the bottom of Long Island Sound, which is said to have $75,000 worth of copper bars in her hold, was started on May 2 by Merritt-Chapman & Scott Corporation, marine salvage experts. The steamship sank off Hatchett reef in February during a storm. Besides the copper the steamer had $5,000 worth of iron bars aboard. The "Winceco" was owned by the American Electric Company, of Phillipdale, R. I., and sailed from Providence.

To us it seems as if Messrs. Merritt-Chapman & Scott lost a splendid opportunity to make real money. They should have started salvaging when copper was selling at 24c. and the bars were worth $100,000.

Ground Broken for Refinery at Copper Cliff, Ont.

Ground was broken this week on the site of the new custom copper refinery at Copper Cliff, Ont., being built for Ontario Refining. Engineers and designers of American Metal decided on the site, which is south of the town of Copper Cliff, in the Sudbury district, and is within a few hundred feet of the main line of the Canadian Pacific. The plants, yards and offices will cover approximately 40 acres. Fraser, Brace & Company, which is building the new International Nickel smelter, is also building the refinery for Ontario Refining.

Eastern Star Purchased by New York Interests

The Eastern Star mine, at Gold Circle, Nev., has been sold to Security Mining, financed by Lenox H. Rand and associates, of New York. The price is reported to be $165,000, which will be expended for development within the next two years. Purchase has been made from N. H. Getchell. A vertical shaft will be sunk 300 ft. The property had been worked by A. J. Stinson, Nevada state mining inspector, and was later sold to John E. Pelton.

Experimental Plant at Trail Destroyed by Fire

The experimental electric furnace building at the Tadanac plants of Consolidated Mining & Smelting, at Trail, B. C., was destroyed by fire on April 25. The adjoining main electric furnace building was saved, however. Operation of the experimental plant had been started only recently.

Hollinger Now Dealing With Government Over Kamiscotia

NEGOTIATIONS between directors of Hollinger Consolidated and the government of Ontario over an extension of the Temiskaming & Northern Ontario Railway from Porcupine to Kamiscotia, Ont., are in progress, according to N. A. Timmins, president of the company. Mr. Timmins says that Hollinger will build a concentrator and resume operations at its extensive Kamiscotia properties if the extension is built. Premier Ferguson of Ontario has subsequently stated that the extention is under consideration. The government is reported to be asking Hollinger for guarantees of tonnage before undertaking the work. If an agreement is reached, a revival of interest in about 400 or 500 copper-gold claims in the Kamiscotia district will probably result.

Teck-Hughes Central Shaft Reaches Depth of 3,000 Ft.

THE central shaft of the Teck-Hughes mine, in Kirkland Lake, has now been completed to 3,000 ft., and crosscutting is under way to open up six new levels. Though no official announcement is expected regarding these developments for a couple of months, within a few days the crosscut on the No. 20 level is expected to reach the vein.

In view of results between the Nos. 10 and 19 levels, the six new levels—Nos. 20 to 25—are expected to show ore that will justify an early addition to the milling capacity. The present high-grade mill consists of two units of 300 tons each, and another unit is expected to be well under way before the end of this year.

The new south shaft is now down 600 ft. and the first connection will be made with the central shaft at 3,000 ft. From the 3,000 level of the central shaft, an incline winze will be sunk on the footwall of the ore, and connections will be made with the new south shaft at intervals of five levels.

Seawell Hydraulic Mining Bill Defeated

The Seawell bill, which asked for an appropriation of $200,000 for the investigation of and purchase of dam sites for débris retention in connection with hydraulic mining, was defeated in the California Assembly on April 30, 1929, by a vote of 42 to 34. A similar bill was defeated in 1927.

Cloverdale to Obtain Power

A hydro-electric plant is being built on Lake Creek, Custer County, Colo., by Cloverdale Mining to furnish electricity for light and power purposes on the properties of the company near Canon City. W. B. Porch is general manager of the company.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Spring Break-Up Permits a Resumption of Airplane Exploration in Canada

TORONTO, May 4, 1929.—With the breaking up of the ice in the Northern lakes and rivers, planes are taking to the air again. During the break-up little flying was possible, but now the skis are being replaced by pontoons, and within the next few weeks airplane prospecting will be more active than ever. All indications point to a very active season. The companies in the field last year will have more planes at their disposal, other large companies are building up an air fleet, and several smaller organizations, with a single plane at their disposal, will also prospect in the North. A pilot for one of the large companies which decided to have a flying organization of its own was recently sent down to Long Island to fly one of the new planes north. He crashed a short time after leaving the base, and has apparently demonstrated to his own satisfaction that planes will not fly successfully without gas, while his company has had a brand new plane go "west." Accidents of this sort in northern flying, however, are rare. During the last year a great deal of flying was done under both summer and winter conditions and the record was remarkably free from accidents of any sort.

OFFICIALS of the Dominion Explorers returned to Toronto in the last week of April after a trip of 8,300 miles from Ottawa to the Sub-Arctics, west to Lake Athabasca and the Great Slave Lake, and then east by way of Lac La Ronge and The Pas to Winnipeg. The trip was made under very hard conditions, the planes encountering snowstorms and blizzards, rough country, and bad ice in the sub-arctics. Seven forced landings were made, and at one time all four planes, losing contact in a blinding snowstorm, found refuge on the same small lake. The trip was made for the purpose of surveying the situation throughout northern Canada and to superintend the placing of prospectors in the field. During the flight 100 men were distributed to various stations, from which they will carry on summer work.

During March Central Manitoba Mines treated 4,815 tons of ore and produced $49,826, an average recovery of $10.35 a ton. On the Tene claim, lying to the east, underground work on the 140 and 250 levels is making good progress, and ore reserves are being increased. The equipment for a cable tramway to connect the shaft on this claim with the mill was brought into the property during the last winter and will be erected this summer.

Operations at the Vipond mine, in Porcupine, are showing results from the development of the new and richer orebodies now being opened up. During April the mill averaged 300 tons a day and produced more than $70,000, of which approximately $30,000 was profit. Cash surplus now stands at $600,000, but no dividends will probably be paid until further substantial additions have been made to the ore reserves.

The Keeley mine, in South Lorrain, has opened up a new high-grade vein in working from the 1,420 level of the Frontier mine of the Mining Corporation. The shoot has been developed for more than 30 ft. This oreshoot is considered to be the extension of one of the principal veins on the upper levels, and the management believes that the most favorable area has not yet been reached. A considerable amount of work was done by the Mining Corporation at this level, but results were not encouraging. It is possible, however, that the work now being done by the Keeley through the Mining Corporation shaft may result in the Mining Corporation doing more work.

The Trout Lake property, in the same district, which is operated by the Mining Corporation, did a considerable amount of work on the lower contact during the last year, but operations resulted in a loss. Silver produced during the year was only 48,093 oz., valued at $31,928. Operating costs were $72,260. This property, after being operated for several years, has finally been closed down. It had a total production of 1,000,000 oz., but finished up with a loss of $46,000.

Leasers on the old Kerr Lake property, in Cobalt, have found a high-grade extension of the Fleming vein. The Fleming was one of the principal producers of the Kerr Lake in the early days, and the leasers have found an undeveloped extension which may prove to be of considerable importance.

Mitchell Addresses Montana School of Mines

In a recent address before the students of the Montana State School of Mines, W. B. Mitchell, superintendent of the zinc refinery of the Anaconda Copper Mining Company, at Great Falls, stated that that plant was the largest electrolytic zinc refinery in the world, producing more than 700,000 lb. of zinc per day. He further stated that Anaconda Copper Mining now produces over 9 per cent of the world's electrolytic zinc.

Kentucky Survey Celebrates Anniversary

Dr. Willard Rouse Jillson, state geologist of Kentucky, announces that the Kentucky Geological Survey, which was established in Frankfort in 1854, with David Dale Owen as its principal geologist, will celebrate its seventy-fifth anniversary this year.

Mexico City Letter

BY W. L. VAIL

Special Correspondent

Commission Will Investigate Desirability of Changing Mexican Mining Law

MEXICO CITY, May 4, 1929.—Appointment of a commission consisting of Leopoldo S. Salinas, mining engineer; Antonio Manero, economist; and Carlos Nava has been announced. This commission will investigate the mining situation and will pay particular attention to demands by mine operators for changes in the existing mining law. Three of the principal demands are the abolition of the present system of exploration concessions, which is considered archaic and extremely harmful; elimination of the time limit on the length of concessions, which hampers development work on a large scale; and facilities for the assistance of the small operators and prospectors. This commission has been appointed by the head of the Department of Commerce, Labor and Industry. The Department of Finance is also making a survey of the situation and will make recommendations on the possibilities of lightening the tax burden.

PRODUCTION for the first four months of the year has shown a decrease from last year's total as a result of the revolutionary activities. A large decrease is reported for Pachuca, the world's greatest silver camp, and decreases are also reported for Jalisco, Sinaloa, Sonora, and Chihuahua, which were the centers of the short-lived rebellion. At El Boleo, in Lower California, production is being increased. An increase of 90 centavos a day in wages has been granted as a result of the labor strike which hampered operations late last year. About 3,000 men are employed at El Boleo, and the mines are the third largest copper producers in Mexico.

Reports from Dos Estrellas state that this company is mining about 2,200 tons daily.

North Lily Developing Mine On and Below 1,200 Level

Important results are expected on the 1,200 level of the North Lily mine, Anaconda subsidiary, in the East Tintic district, Utah, where the company is developing ground in a synclinal formation, with the Ophir formation displaced into the Cambrian quartzite. Similar conditions have obtained in areas where the important orebodies have been found to date, both in the North Lily and in the adjoining Tintic Standard. The shaft is being sunk below the 1,260 level, or about 1,558 ft. below the surface at the collar. Sinking will be continued to the quartzite.

Societies, Addresses, Reports

Chamber of Commerce Holds Annual Meeting in Washington

By PAUL WOOTON
Special Washington Correspondent

RESOLUTIONS dealing with the credit situation, agriculture, reduction of armaments, railroad rate-making, merchant marine, legal procedure, taxation, tariff, import and export prohibitions, immigration, commercial aeronautics, the mineral industries, passports, trans-Pacific press messages, distribution studies, the forest reserves, highway appropriations, traffic regulation, daylight saving, fire waste, health conservation, and accident prevention were adopted at the final session of the seventeenth annual meeting of the Chamber of Commerce of the United States, in Washington, April 29-May 2.

Julius H. Barnes was selected as the chairman of the board of directors for the ensuing year. William Butterworth was re-elected to the presidency of the organization. Among the vice-presidents, W. Rufus Abbott, of Chicago, was elected to represent the North Central states. Charles W. Lonsdale, of Kansas City, was elected for the Southwestern group. The vacancy in the northwestern vice-presidency was not filled. The other vice-presidents were re-elected as follows: Robert R. Ellis, of Memphis, Southeastern states; Alfred J. Brosseau, of New York, Northeastern states, and Paul Shoup, of San Francisco, Western division.

The resolution dealing with the credit situation acknowledges the difficulty of preserving the orderly balance of finance and credit under new conditions. It urges that the capacity of the country to absorb new security issues be weighed carefully. "Basic industries," says the resolution, "especially the smaller units of manufacture, distribution, and agriculture, should not be burdened with unusually high interest rates resulting from security excesses." The Chamber, however, expressed full confidence in the ability of the federal reserve system to adapt itself to new conditions and besought for it the utmost co-operation.

In its resolution on agriculture the Chamber stood unqualifiedly for equality in tariff protection between agriculture and manufacturing industries. It favors a new federal agency to deal with these problems and it was recommended also that the Chamber should have a committee of its own for the sole purpose of following closely the work of the farm board. This committee is to pay particular attention to research and the utilization of agricultural products and byproducts.

"We regard it as unwise and contrary to sound public policy for Congress itself to fix rates." This is a sentence from the resolution on railroad rate-making. Elaborate investigations which postpone rate adjustments were decried.

The contract principle should be applied, the Chamber declares, to assist in completing the disposal of the Shipping Board lines and at the same time provide for the development of overseas shipping services, including the movement of the seasonal peak of traffic. The function of the Shipping Board thereafter should be that of an agency to carry on the regulation of the relation of merchant shipping to the public.

Efforts to minimize the power of federal courts, or to diminish their jurisdiction, or to substitute the legislative will for the discretion of the court were decried.

The present rate of federal tax on corporation income was held to be "burdensome on productive enterprise" and a discrimination against the corporate form of business enterprise.

The Chamber expressed a desire that the established Tariff Commission "should be strengthened by the necessary authority for expeditious determination of those questions with full responsibility under the President."

The Chamber recommended the repeal of the national origins provision of the immigration law and suggested the continuance of the quota limit system based upon 2 per cent of the foreign born living in the United States in 1890.

Carrying through the request of the California Development Association the Chamber adopted a resolution calling attention to the importance of the mining industry and the need for greater governmental co-operation.

Increased federal funds for use on the interstate road system was recommended so as to release state and local funds for secondary roads. Investigation, research, and experimentation on forestry problems was advocated. Congress should take prompt action, another resolution states, on legislation looking to the appointment of engineer advisers to the American republics.

"Congress should provide more adequate appropriations for detailed, co-operative distribution studies with those fields of industry which are interested," says another of the resolutions adopted. The establishment of airports and the encouragement of the use of aircraft was urged. Unqualified support was pledged to the President and the federal government in every effort looking to the suppression of war as an instrument of national policy.

Government policies relating to raw materials and water power were the subject of a discussion at a well attended round-table conference on Tuesday, April 30, under the auspices of the Natural Resources Division of the Chamber. Dr. John C. Merriam, president of the Carnegie Institution, of Washington, presided, and W. DuB. Brookings, of the Chamber staff, served as secretary of the conference. As the keynote of the conference the chairman suggested the problem of protection of resources without loss of stimulus and incentive for adequate and sound development without waste. The accomplishment of this objective, he stated, is now possible because of "the application of business in science" and the keen appreciation by business of the necessity for the use of science, an interlocking between the two agencies being of great importance, in his opinion.

R. C. Holmes, president of The Texas Company and chairman of the American Petroleum Institute committee on control of production, reviewed the history of the efforts of his industry to curb excesses of crude oil production.

Aaron H. Hover, of Hollywood, Calif., presented to the round table a formal prepared criticism attacking the administration policy of restricting the development of permits for oil exploration on public lands. He argued that the sudden reversal of law and of practice has worked an injustice to producers who have expended considerable money but have not reached the point of development and are thereby caused substantial losses when change is made without warning.

The discussion of coal resources and coal problems was opened by C. E. Bockus, president of the Clinchfield Coal Corporation, who characterized his industry as "investigated to death."

Harry L. Gandy, secretary of the National Coal Association, drew the analogy between the problems of coal and oil in their difficulty of handling overproduction and excess producing capacity, and Judge William S. Bennet, of the Edward Hines coal and lumber interests, took some exception to Mr. Gandy's interpretation of the present significance of the anti-trust laws as indicated by the Trenton Pottery case, which both men cited. Judge Bennet spoke of the timber problem of the country as well as of the coal problem.

Major R. Y. Stuart, chief forester of the U. S. Forest Service, enlarged upon the theme of permanent wood supply and Everett G. Griggs, president of the St. Paul & Tacoma Lumber Company, stressed the necessity of co-operation between federal and state government and all branches of the industry in preservation of timber resources.

MARKET AND FINANCIAL NEWS

U. S. Smelting Earnings Improved Substantially in 1928

UNITED STATES Smelting Refining & Mining Company reports net profit, after depreciation, depletion, and amortization, of $4,097,200 for the year ended Dec. 31, 1928, compared with $3,031,328 in 1927 and $3,039,164 in 1926.

Consolidated Profit-and-Loss Account for 1928

Earnings, after expenses and federal taxes		$6,662,015
Interest on funded debt		445,517
		$6,216,498
Reserve for depreciation, depletion, and amortization		2,119,297
Profit for 1928		$4,097,200
Surplus as per previous balance sheet		$17,629,242
Profit for 1928		4,097,200
		$21,726,443
Dividends:		
Preferred	$1,702,225	
Common	1,228,902	
	$2,931,127	
Additional reserves (being all surplus earnings for the year in excess of dividend requirements)	1,166,073	4,097,200
Surplus as per balance sheet		$17,629,242

On Dec. 5, 1928, authority was given for the issuance of 219,447 additional shares of common stock. Stock so offered was all subscribed, taken, and paid for early in January, 1929. The purpose of this issue of stock was to retire the outstanding debentures, and for general corporate purposes. The $8,000,000 debentures were called for redemption, according to their terms, on their next interest payment date, May 1, 1929, after which date the securities of the company issued and outstanding will be: Issued preferred shares, 486,350; par value, $24,317,500; issued common shares; 570,562, per value, $28,528,100.

At the company's mines in Bingham, Utah, the tonnage and grade of ore mined during 1928 were substantially the same as for 1927 and 1926. Realization was less, owing to lower prices of lead and zinc. The average price of lead for the year, as quoted in the *Engineering and Mining Journal*, was 6.305c., against 6.755c. for 1927 and 8.417c. for 1926; average price of zinc (at East St. Louis) for 1928 was 6.027c., against 6.242c. in 1927 and 7.337c. in 1926.

Exploration and development at the Bingham properties have disclosed interesting possibilities for the future. At the Midvale plant the lower lead prices caused a shortage of lead ores and reduced bullion production. The new flue system for the handling of waste gases was completed, and the anticipated improvement in the operating efficiency of the smelter was realized. The performance of the whole plant, including the flotation mill, was satisfactory; and despite the reduction in tonnage, production costs were, on the whole, lower than in the previous year. Substantially all of the lead from the Bingham mines and Midvale plant was refined at the company's refinery at East Chicago, Ind., which has been operated with high efficiency and with improvement of costs over the record for the preceding year.

At the Sunnyside mines, at Eureka, Colo., the mill treated a somewhat larger tonnage than in 1927. The grade was substantially the same. The capacity of this mill has been increased. At the Hanover Bessemer mines, at Fierro, N. M., the tonnage production was less than for the previous year, owing to a decreased demand for the ore. The new cobbing plant, for the purpose of increasing the grade of ore shipped—construction of which started in 1927—was completed in 1928, and the results of its operations have been up to expectations.

At the Mexican properties of the Compania de Real del Monte y Pachuca, the Loreto and Guerrero mills treated slightly less tonnage than in 1927. The grade, however, was higher, and the silver production was the greatest in the history of the company. Exploration and development were actively continued throughout the year, resulting in some interesting discoveries, which, together with further development of known orebodies, should help to maintain the ore reserves, which at the end of the year were approximately the same as at the close of the previous year.

As a measure of economy the company recently decided to increase the capacity of the Loreto mill to equal the combined present capacity of the Loreto and Guerrero mills, and, when these changes are accomplished, to close down the Guerrero mill. This work is now under way, and it is hoped to have it completed by April, 1930.

At the dredging fields at Fairbanks, Alaska, the construction and development program was carried on throughout the year. The power plant was put in operation early in the season. The supply of power was ample, and the performance of the plant satisfactory. During the season three dredges were erected on the ground and started dredging. The Davidson ditch began delivery of water to the Cleary district in August, but will not be ready to deliver water to the Goldstream district until the 1929 season. Special attention was given to the preparation of ground, and the season ended with a substantial amount of prepared ground ahead of the dredges. Two additional dredges were ordered late in the year, and are now being fabricated at the Bethlehem Shipbuilding Plant in San Francisco. It is expected that these dredges will be shipped early in the season, and will be erected so as to commence dredging in the season of 1930. At Nome, Alaska, the main objective during the season was the preparation of ground, dredging being curtailed with a view to putting ahead of the dredges a proper amount of thawed material. At the Ebner mines, operated under lease by the Alaska Juneau Gold Mining Company, near Juneau, Alaska, the tonnage of low-grade gold-bearing ore produced during the season was slightly in excess of the tonnage produced in 1927. The U. S. S. R. & M. does not publish production statistics.

NORTH LILY MINING COMPANY reports net income for the first three months of 1929 as $318,969, or at the rate of 40c. a share quarterly, or $1.60 annually, as compared with current dividends of $1 per share annually. Sales of ore amounted to $525,095. Shipments totaled 17,280 dry tons. Gross value of the ore was $38.80 a ton, and net return, after mining, shaft sinking and freight, amounted to $19.50 per ton. Net quick assets as of March 1, 1929, amounted to $915,660.

NON-FERROUS INGOT METAL INSTITUTE has been engaged for several months in gathering statistics as to specifications for ingot brass. These data are being used by a special committee of the American Society for Testing Materials to determine the relative importance in volume of each distinctly separate alloy. Within a reasonable time, the Institute hopes to develop through the American Society for Testing Materials a fairly complete set of specifications covering the bulk of ingot brass requirements for all purposes. Eventually, the Institute will probably undertake a comprehensive program of technical research to increase accuracy in manufacture and in casting; and to determine the most efficient and economical mixtures and methods for the use of these metals for all purposes.

Tintic Standard Net Income Declined Further in 1928

NET INCOME of Tintic Standard Mining Company declined to $1,493,934 in 1928, from $1,824,497 in 1927 and $2,688,359 in 1926. A curtailment in output was effected about the middle of the year after the price of lead had declined considerably. Income account for 1928 follows:

Statement of Operations

Gross sales	$4,446,615	
Smelter deductions	1,810,071	
Proceeds from ore sales		$2,636 544
Miscellaneous income		286,047
Total income		$2,922,591
Mine operating expenses	$1,001,984	
General and administrative expenses	103,928	1,105,913
Net income, before depreciation and taxes		$1,816,678
Provision for depreciation:		
Mine plant and equipment	$46,616	
Mill plant and equipment	252	46,869
Net income (before deducting taxes)		$1,769,808
Taxes:		
State and county	$120,537	
Federal corporation income taxes	155,336	
Total taxes		275,873
Net income, carried to surplus		$1,493,934

Metal production for 1928 and 1927 compares as follows:

	1928	1927
Gold, oz.	9,262	5,861
Silver, oz.	3,141,298	3,295,086
Lead, lb.	40,003,096	43,687,436
Copper, lb.	902,365	742,783
Bismuth, lb.	2,478	10,010

At the Tintic Standard mine development work to the extent of 5,870 ft. of drifting and 1,004 ft. of raising was carried on during the year. Work was continued on the 800, 900, 1,000, 1,250, and 1,350 levels, with satisfactory results.

At the Eureka Standard mine, on the 1,100 level, an orebody of great importance was developed. The ore was found in the Cambrian quartzite underlying the limestone beds from which the ores have heretofore been mined, and is in the footwall side of the Eureka Standard fault. By Dec. 31, 1928, the orebody had been developed for 450 ft. on its strike, and it extends from the 1,000 level to the 1,220 level. The average width above the 1,100 level is approximately 6 ft. and is the same below that level so far as limited development shows. The ore, as determined by 4,295.8 tons shipped, averaged 0.77 oz. gold and 10.6 oz. silver per ton.

At the Iron King mine, development work disclosed, on the 1,450 level, a fissure which contained some ore. The main shaft was sunk to the 1,550 level, and a new crosscut on the lowest level is being run to develop this fissure.

At the Colorado, development work was confined to a single drift on the 1,900 level of that mine, which was advanced 433 ft. No ore of importance was found.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54
1928	99.78

	1927	1928	1929
January	100.46	97.54	106.86
February	100.01	96.73	110.37
March	100.84	96.22	122.71
April	98.63	97.14	116.36
May	96.41	99.05	.....
June	95.55	100.16	.....
July	95.42	99.69	.....
August	97.25	99.85	.....
September	96.01	100.53	.....
October	95.36	102.34	.....
November	96.22	103.83	.....
December	98.30	104.28	.....

ROAN ANTELOPE COPPER MINES, LTD., recently voted to increase its capital to £1,250,000 by the creation of 1,000,000 new 5s. par shares. A. Chester Beatty, chairman, stated that shareholders may subscribe to shares at 39s. per share at the rate of one new share for every three old shares held.

Tasmanian Mineral Production £1,593,828 in 1928

MINERAL PRODUCTION in the State of Tasmania during 1928 had a total value of £1,593,828, distributed as follows:

Mineral	Quantity	Value
Cadmium, tons	19.8	£4,329
Carbide, tons	3,829	68,877
Copper, tons	6,421	444,802
Coal, tons	128,500	106,558
Cement, tons	44,799	189,380
Copper nickel, tons	10	1,697
Gold, oz.	3,603.4	15,306
Lead, tons	4,786.7	101,616
Limestone, tons	98,654	79,050
Osmiridium, oz.	1,627	42,458
Silver, oz.	669,326	78,901
Shale, tons	2,595	1,297
Tin, tons	1,140	258,676
Talc, tons	32	96
Wolframite, tons	176	12,094
Zinc, tons	7,112	188,691
Total	.....	£$1,593,828

The Electrolytic Zinc Company recovered 44,004 tons of zinc, valued at £1,199,596, and 152 tons of cadmium, valued at £34,437, from other than Tasmanian ores, and employed an average of 941 men, according to A. B. Bryan, Acting Secretary for Mines of Tasmania.

Sudbury Claims Consolidated

A consolidation of properties, including 49 claims in three groups in various parts of the Sudbury district of Ontario, Canada, is involved in the incorporation of Walsh-Aquino Mines, Ltd., a new company with a capitalization of $5,000,000 in shares of $1 each. The holdings of the company include claims in Snider Township, located between the Creighton Mine and Copper Cliff; claims in Mongowan Township, adjoining the McMillan Gold Mine, and claims in Dowling Township on the north arm of the contact of slates and tuffs in the interior of the basin. A total of 500,000 shares has been issued in payment for the properties.

ASHEVILLE MICA COMPANY, of Asheville, N. C., has purchased the mica manufacturing business of the Erwin Feldspar Company, of Spruce Pine, N. C.

Current Statistics of Production and Stocks of Copper, Lead, and Zinc

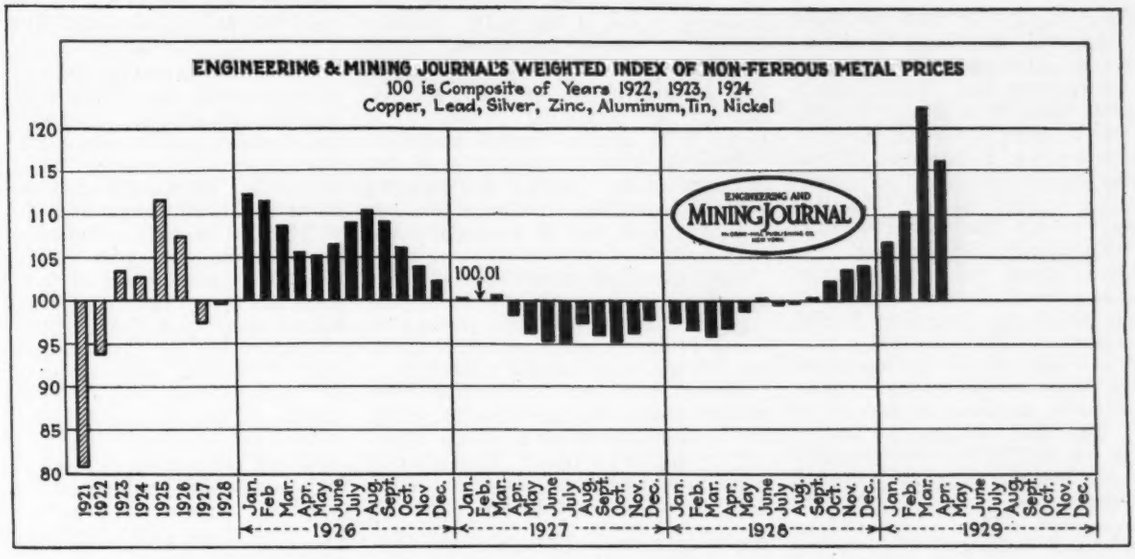
Data from American Bureau of Metal Statistics

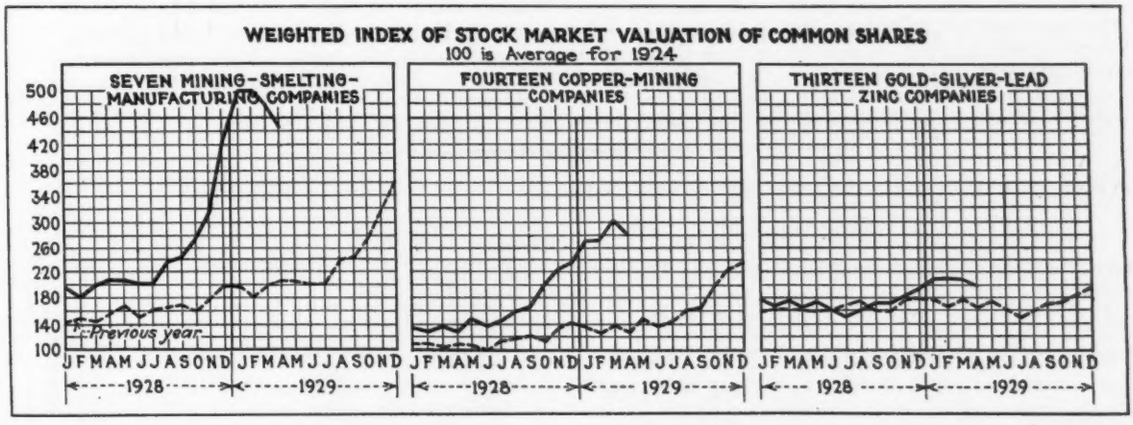
Figures Represent Short Tons

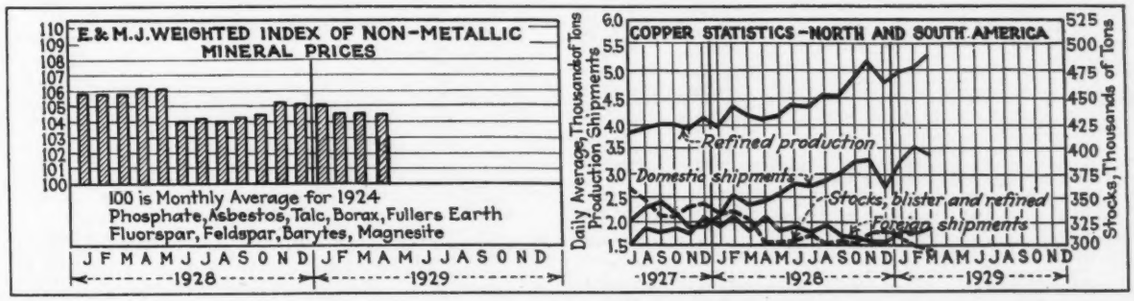
	1927		1928								1929		
COPPER—North and South America	Average	Dec.	Jan.	Feb.	March	Sept.	Oct.	Nov.	Dec.	Average	Jan.	Feb.	March
Production, refined, daily average	4,045	4,159	3,959	4,305	4,160	4,567	4,813	5,182	4,771	4,448	4,983	5,049	5,276
Domestic shipments	68,737	60,862	64,824	73,789	72,642	88,707	100,371	99,822	84,889	81,955	100,135	98,771	105,860
Foreign shipments	53,489	63,637	56,721	60,603	55,970	51,292	54,992	49,121	49,703	57,185	57,054	50,150	59,946
Stocks, blister and refined	335,311	327,478	318,137	318,161	313,408	290,954	287,380	297,007	315,461	300,771	307,959	296,298	295,309
LEAD—United States and Mexico													
Production, smelter, daily average	2,513	2,517	2,479	2,630	2,508	2,503	2,603	2,821	2,700	2,514	2,656	2,559	2,574
Production, U. S. mines, daily average	1,798	1,833	1,755	1,896	1,872	1,839	1,875	1,934	1,846	1,785	1,891	1,723	1,648
Imports into U. S. A.	13,451	10,587	10,418	8,574	12,556	11,215	15,350	16,935	16,767	12,757	22,924	9,551	.....
Stocks, smelter and refinery	156,878	155,280	157,417	167,692	173,411	155,482	152,746	157,485	161,460	160,511	156,182	160,597	158,683
ZINC—United States													
Production, daily average	1,681	1,699	1,691	1,726	1,803	1,645	1,621	1,675	1,632	1,693	1,604	1,720	1,790
Domestic deliveries	45,811	46,483	45,771	46,754	51,856	44,103	50,126	48,698	49,625	48,301	47,677	51,057	56,267
Exports, slab zinc	3,468	1,042	4,644	2,125	2,558	127	884	714	(a)	(a)	(a)	(a)	(a)
Exports, ores and dross	4,424	2,388	2,444	890	1,898	346	90	114	587	453	545	165	.....
Stocks	37,602	40,751	42,163	41,290	41,529	47,915	46,068	46,542	45,441	44,333	45,418	40,620	37,962
World Production Rate (Daily Average)													
Copper	4,543	4,805	4,631	5,088	4,769	5,251	5,698	6,127	5,782	5,236	5,767	5,968	6,219
Lead	4,514	4,456	4,859	5,067	5,158	4,950	4,937	5,425	5,265	4,976	5,037	5,068	4,907
Zinc	3,910	4,099	4,179	4,285	4,394	4,182	4,223	4,385	4,426	4,271	4,231	4,357	4,448

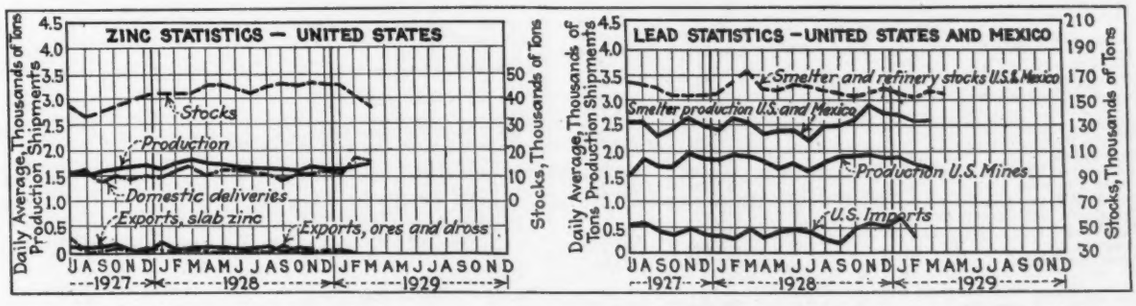
(a) Withheld pending investigation of government reports.

E. & M. J. Statistics of the Mining Industries









London Financial News

By W. A. DOMAN
Special London Correspondent

LONDON, April 23, 1929. — Copper shows signs of recovering from the nervousness which characterized it last week. One point that seemed incomprehensible was the wide gap between the prices of electrolytic and standard. At one time it was no less than £20 per ton, whereas normally it is only about one-quarter of that figure. This was attributed to speculation, with heavy selling of standard. As the position is regarded as sound, the margin is narrowing, as a result of what are said to be repurchased and American buying for consumption. There is still a bear account, and the covering operations are expected to take the price higher. Union Minière produced at the rate of 129,600 tons per annum in March. Whether this will be exceeded remains to be seen, but the company hopes to reach 140,000 tons, and, later, 200,000 tons per annum. This is expected to have a great influence upon world prices, and judging by the published figures of the ore reserves and their value, the rate can be continued for many years. Chile Copper is said to have immense deposits of copper ore not yet touched, though Union Minière gives signs of becoming a competitor.

Last week I mentioned the formation of the Zinc Manufacturing Company. This has now been registered with a nominal capital of £1,000,000 in 1,800,000 "A" ordinary shares and 200,000 "B" ordinary shares of 10s. each. Holders of the "A" shares are entitled to receive 75 per cent of the profits distributed as dividend in any year, the "B" getting the remaining profits. The object is to acquire licenses under the Coley process for the production of zinc and zinc oxide. Among the directors is H. E. Howard, a director of Stewarts & Lloyds, Ltd., and N. C. Metal Company, Ltd.

Another conference will be held within the next few days at Brussels to consider the restriction of zinc production. Polish producers advocate freedom, but the Belgians stand out for restriction.

A few years ago St. John del Rey suffered from a shortage of labor, which had been enticed away to follow farming at higher wages. The position seems to be improving, and the government is taking steps to see what can be done to improve the situation further. The company has returned to the dividend list by paying 1s. 6d. per share.

A message from Johannesburg announces the registration of the Manganese Corporation, Ltd., with a capital of £1,000,000 in £1 shares, this being the outcome of an agreement between Union Manganese Mines & Minerals and the British Swiss Corporation. The Union company receives as purchase price £225,000; £200,000 will be provided in cash; the British Swiss Corporation will subscribe £200,000, and there will be in reserve £375,000.

KIRKLAND LAKE GOLD MINING COMPANY'S annual report for 1928 shows that the mill treated 57,883 tons of ore and produced bullion valued at $414,596, with an average recovery of $7.16 per ton. Costs totaled $383,319, leaving a profit of $31,000, compared with a profit of $113,000 in 1927. Capital expenditures during the year amounted to $58,000, the greater part of this expense being for a new underground hoist. A balance sheet as of Feb. 28, 1929, shows production for the first two months of 1929 of $62,332, and expenditures for the same period were $68,209. The surplus at the end of February stood at $554,327. Mining costs for development and exploration were $2.42 a ton; for mining, $2.53; milling, $1.69; a total of $6.64. During the year the winze was sunk from 2,730 to 3,250 ft. and crosscuts were driven at the 2,725, 2,850 and the 2,975 levels. Stations have been cut at 3,100 and 3,225 ft. Ore was encountered at the 2,600, 2,725 and 2,850 levels. Profit-and-loss account shows a credit balance on Dec. 31, 1928, of $168,938, and on Feb. 28, 1929, this stood at $167,531.

Imports and Exports of Ores and Metals in March, 1928 and 1929

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

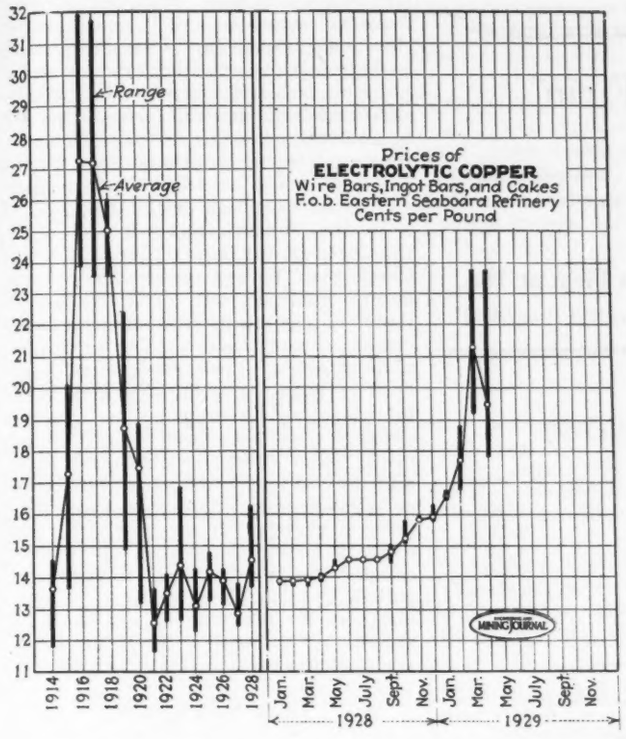
Imports

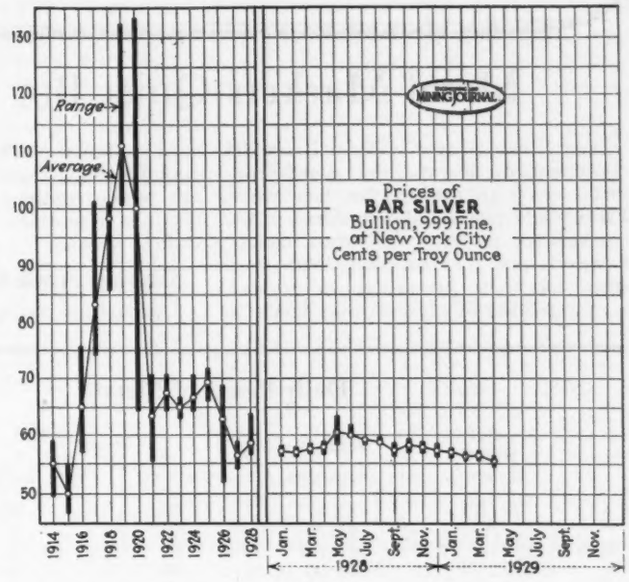
	March 1928	March 1929
Antimony		
Ore — Gross weight	228,206	905,664
Ore — Antimony content	124,445	580,686
Copper		
Ores, copper content	10,536,493	12,274,169
Concentrates, copper content	3,930,111	3,774,900
Regulus, coarse metal, cement copper	235,646	119,072
Imported from:		
Spain	1,151,629	1,151,381
Canada	3,613,029	5,664,778
Mexico	4,052,073	2,923,640
Cuba	1,995,500	828,200
Chile	3,771,301	5,171,957
Peru	88,789	100,877
Other countries	29,929	327,308
Unrefined black, converter copper in pigs, bars, and other forms	29,963,179	53,247,790
Refined copper	4,314,758	16,737,060
Old and clippings for remanufacture	834,212	704,567
Composition metal, copper chief value	.....	22,400
Brass, old, for remanufacture	877,280	1,351,718
Lead		
Ore and matte, lead content	3,975,599	2,356,683
Bullion or base bullion	21,128,919	14,410,426
Pigs and bars	8,863	1,333
Babbitt, solder and other forms — Lead content	204,799	190,485
Babbitt, solder and other forms — Gross weight	90,482	83,334
Type metal, antimonial lead — Gross weight	1,139	1,456,138
Type metal, antimonial lead — Lead content	796	1,235,588
Manganese, tons		
Cuba, manganese content	172	112
Other countries, manganese content	12,786	18,089
Pyrites, tons	46,612	56,735
Tin, ore, tons	6	10
Bars, blocks, pigs	18,229,787	16,653,393
Imported from:		
Netherlands	1,457,210	1,086,961
United Kingdom	3,041,059	5,437,376
British Malaya	12,583,231	9,535,554
Netherland East Indies	137,193	.....
Hongkong	259,749	235,531
Australia	256,400	184,920
Other countries	494,945	173,051
Zinc		
Ore, zinc content — Free, less than 10 per cent zinc	.....	.....
Ore, zinc content — Dutiable	192,980	5,460,073
Blocks, pigs and other forms, old	.....	557

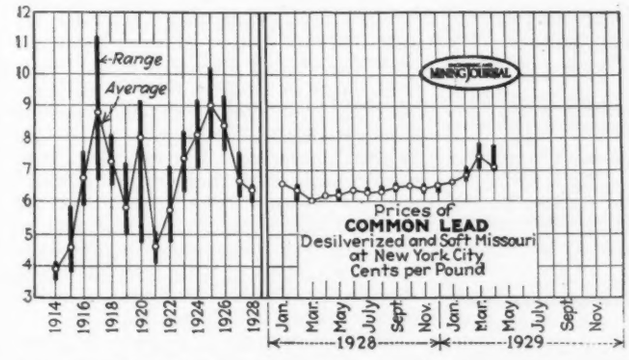
Exports

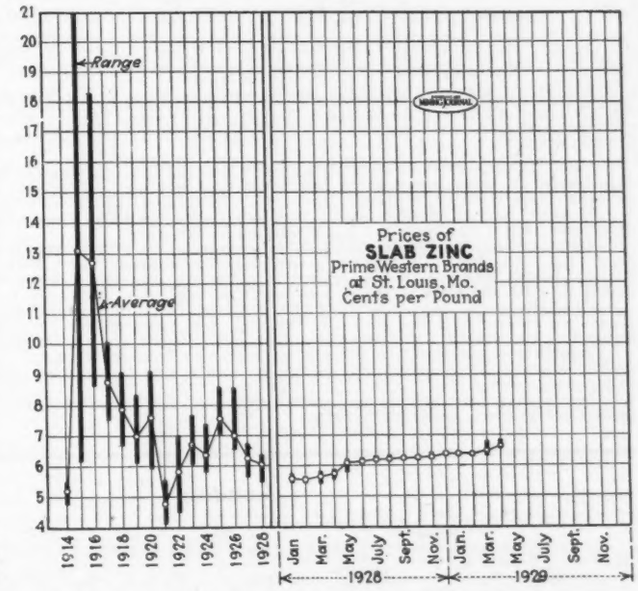
	March 1928	March 1929
Copper		
Ores, composition, concentrates, unrefined	379,846	130,050
Refined copper in ingots and other forms	83,076,505	71,745,133
Exported to:		
Belgium	9,023,832	3,470,131
France	14,274,934	19,220,966
Germany	18,188,699	14,889,470
Italy	8,404,323	7,755,505
Netherlands	8,306,198	3,384,392
Spain	212,697	582,534
Sweden	2,064,553	1,985,416
United Kingdom	16,775,587	15,488,883
Other Europe	1,459,081	426,983
Canada	1,220,160	3,953,026
British India	1,204,348	56,000
China, Hongkong, Kwantung	1,115,267	175
Japan	746,118	.....
Other countries	80,708	531,652
Old and scrap	5,548,987	6,959,317
Pipes and tubes	346,988	446,008
Plates and sheets	287,865	631,479
Rods	6,450,893	5,579,472
Insulated copper wire and cable	1,690,437	3,024,321
Lead		
In pigs, bars, and other forms	19,277,678	18,011,286
From domestic ore	217,145	8,804,983
From foreign ore	19,060,533	9,206,303
Exported to:		
Belgium	.....	672,149
France	2,464,748	336,095
Germany	2,632,905	5,724,727
Netherlands	1,064,275	448,052
Sweden	1,075,581	1,748,077
United Kingdom	6,274,243	4,817,787
Other Europe	560,214	1,465,666
Brazil	582,557	560,152
Other South America	67,183	298,373
China, Hongkong, Kwantung	673,375	.....
Japan	3,641,851	1,793,377
Other countries	240,746	146,831
Other lead manufactures	1,324,668	1,807,798
Zinc:		
Ores and concentrates, tons	1,486	5
Dross	468,451	953,384
Cast in slabs, blocks and pigs	5,116,145	2,761,897
Exported to:		
Belgium	61,050	33,610
France	392,091	1,243,335
Germany	1,512,056	195,556
Italy	560,183	.....
Netherlands	217,992	195,441
United Kingdom	588,457	362,639
Other Europe	11,303	414,427
Japan	1,623,685	.....
Other countries	149,328	316,889
Sheets, strips and other forms	664,916	706,303
Dust	309,759	332,950
Other zinc manufactures	668,602	72,385

Metal Price Curves

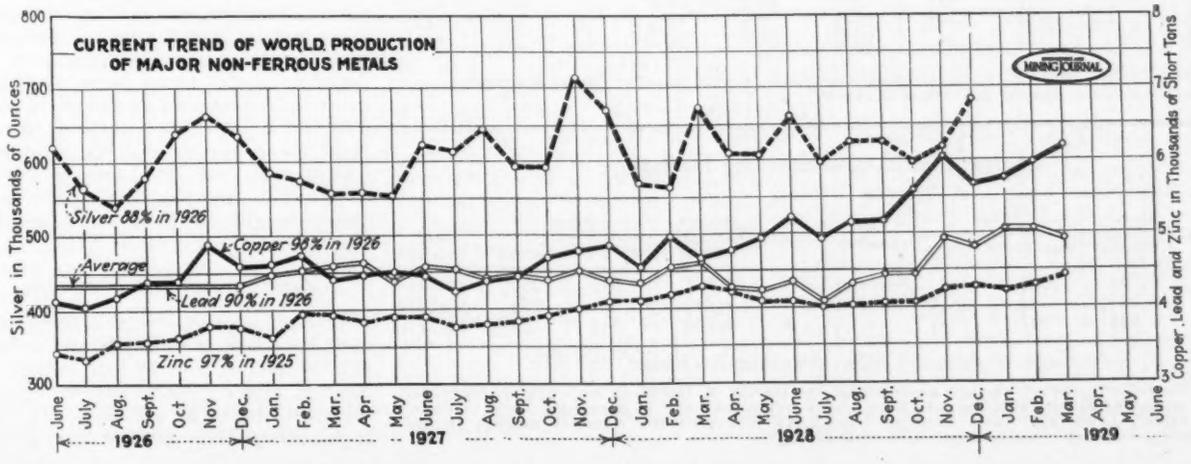








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly the horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics upon Mexico accounts for the failure of the silver curve to be up to date.



The Market Report

Metal Markets Quiet But Firm

New York, May 8, 1929 — Inactivity continued to feature the non-ferrous metal markets during the last week. Firmer undertones have appeared in the markets for the more important metals, however, and the immediate outlook is somewhat more promising for at least a continuation of present price levels in most instances. The minor metals are quotably unchanged, though tungsten ore prices continue to advance as the result of a shortage that appears world-wide in scope.

Copper Appears Firm at 18c.

Demand for copper, both for domestic and foreign account, has continued light during the week ending today. Foreign business, however, though considerably below normal, has been the largest for any week since late March. Various factors in the trade interpret this improvement to portend an even greater improvement that seems certain to result from settlement of the reparations question, generally considered to be an event scheduled for the immediate future. Copper Exporters, Inc., maintains its price at 18.30c. per pound, c.i.f. usual European destinations.

In the domestic markets, all sales have been on the basis of 18c., delivered Connecticut Valley, and the larger producers continue out of the market, thereby permitting the offerings of custom smelters and smaller producers to be absorbed. Positions specified have been in large part for May and June, though a sizable tonnage for August delivery has been sold also. Shipments from refineries continued at a high rate in April, and stocks of refined copper are expected to appear substantially unchanged in the A.B.M.S. statistics available about May 13. Fabricators have shown some tendency to anticipate forward deliveries in several instances, though this tendency has been limited by the ability of refineries to make additional shipments.

Lead Still Quiet

The tonnage of lead sold this week was slightly greater than the week before, but the volume of sales continued well below that of an average week. Two large consumers bought moderate tonnages, but almost without exception the rest of the buying was in carload lots and for prompt delivery. It is generally considered that lead consumers are not so well bought ahead as are those of copper and zinc, and that at least half of consuming requirements for June remain to be purchased. This should result in a much more active market before the end of May.

Prices reported on Eastern business seem uniformly on a 7c. New York basis, which continues to be the contract price of the American Smelting & Refining Company. In St. Louis, no lead was reported sold, either chemical or desilverized, for less than 6.80c., though one seller offered lead at 6¾c. this afternoon. Desilverized lead is obtainable at several Mid-Western consuming centers, also at prices which, if reduced to a St. Louis basis, would be in the neighborhood of 6.75c. Omaha lead might have been obtained in Detroit, for example, at 6.95c., the local freight rate from St. Louis to Detroit being 0.205c. per pound, the price being determined by the New York quotation rather than the St. Louis basis.

Zinc Somewhat Stronger

Though sales of zinc during the past week have been quite small, and in large part accounted for by one seller, the position appears somewhat stronger as the week draws to a close. The company selling freely at 6.60c. during most

Daily Prices of Metals

May	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
2	17.775	43.875	7.00	6.80	6.60
3	17.775	43.75	7.00	6.80	6.60
4	17.775	43.75	7.00	6.80	6.60
6	17.775	44.00	7.00	6.80	6.60
7	17.775	44.00	7.00	6 80	6.60@6.625
8	17.775	44.375	7.00	6.80	6.60@6.65
	17.775	43.958	7.000	6.800	6.606

Average prices for calendar week ending May 4, 1929, are: Copper, 17.775; Straits tin, 43.875; N. Y. lead, 7.000; St. Louis lead, 6.800; zinc, 6.600; and silver, 54.750.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
2	78½	75¼	83	196¼	199	24⅛	24⅛	26⅝	26¾
3	79	75	83½	197	199½	24 7/16	24 1/16	26 9/16	26⅝
6	79⅞	76¼	84¼	197½	199⅝	24 7/16	24⅛	26 7/16	26 11/16
7	79⅜	75⅜	84¼	197⅜	200⅛	24 7/16	24⅛	26⅝	26 11/16
8	78	75⅜	84	200⅞	202¼	24 9/16	24 1/16	26⅝	26 13/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

May	Sterling Exchange "Checks"	Silver		Gold London	May	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
2	4.84¾	54⅜	25¼	84s11½d	6	4.84¾	54⅞	25 5/16	84s11½d
3	4.84 13/16	54⅜	25 3/16	84s11½d	7	4.84¾	55	25⅛	84s10⅜d
4	4.84¾	54⅞	25 5/16	.....	8	4.84¾	54½	25 5/16	84s11½d

Average: Silver, 54.792c.; Sterling Exchange, 484.760c.

New York quotations are as reported by Handy & Hartman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

of the week raised its price to 6.65c. per pound yesterday, and sales were reported at that level. Most of the producers are out of the market, being disinclined to sell below 6.75c. per pound, East St. Louis basis, and feeling that the present strong statistical position is bound to result in an opportunity to sell at their own price sooner or later.

April statistics released by the American Zinc Institute, in tons of 2,000 lb., follow:

Stock April 1	37,962
Produced	54,653
Shipped	58,027
Stock April 30	34,588
Shipped from plants for export	1,469
Metal sold but not delivered April 30	42,828
Total retort capacity April 30	119,786
Number idle retorts available within 60 days	43,241
Average number of retorts operating in April	73,289
Number retorts operating April 30	73,319

Tin Slightly Higher

Tin prices have been steadier this last week, with a slight upward tendency, bringing today's quotation to 44⅛c. for prompt Straits. A moderate consuming demand has been noted. The increased strength seems to be attributable to the fact that the Anglo-Oriental group has again been supporting the market at recent levels, and also to the rumors from London that some common efforts might be made by producers to regulate output to accord with consuming demand. Futures have been quoted at a premium of about one-eighth cent.

Foreign Exchange

Closing cable quotations on the principal foreign exchanges on Tuesday, May 7, were as follows: Francs, 3.90⅛c.; lire, 5.24c.; and marks, 23.72½c. Canadian dollars, $\frac{31}{32}$ of 1 per cent discount.

Silver Weak at 54½c.

During the last week the market continued inactive until May 7, when good buying for China account resulted in a sharp rise of 3/16d. in the London price, which was only reflected in a rise of ⅛c. in the New York market. On account of a reversal in China's position the following day the market again sagged, resulting in a decline of ½c. in the New York price. The tendency is uncertain.

Mexican Dollars (old Mexican pesos): May 2d and 3d, 41½c.; 4th and 6th, 41⅜c.; 7th, 41½c.; 8th, 41c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, 9c. per lb. for all positions. Cookson's "C" grade, spot, 14½c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM — Per lb., New York: 85@95c. Active demand.

IRIDIUM—Per oz., $260@$265 for 98 @99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $38@$40. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $70. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

QUICKSILVER — Per 76-lb. flask, $122 cash. Small lots command the usual premiums.

Prices of Chromium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Titanium, Tungsten, Vanadium, and Zirconium are unchanged from the issue of May 4.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $16; Western scheelite, $16.50 bid, none offered. Nominal.

Antimony, Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the May 4 issue.

Tri-State District Faces Forced Restriction of Output

Joplin, Mo., May 4, 1929

Blende

	Per Ton
High	$46.50
Premium blende, basis 60 per cent zinc	$44.00@ 45.00
Prime Western, basis 60 per cent zinc	43.00@ 44.00
Table concentrates, 60 per cent zinc	41.00@ 43.00
Flotation concentrates, 60 per cent zinc	38.00@ 41.00
Average settling price, all zinc	43.14

Galena

High	$93.80
Basis 80 per cent lead	90.00
Average settling price, all lead	91.68

Shipments for the week: Blende, 9,442; lead, 2,396 tons. Value all concentrates the week, $627,060.

Production of zinc concentrates was lowered slightly this week. It is estimated that it will be lowered 20 per cent next week. Mining companies facing disorganized operating crews, have decided to reduce working forces on a systematic basis that will permit those who so desire to make of May and June a vacation period. Berry pickers are needed, and the men, women, and children can all find employment, thus earning a living while enjoying the change. Though this appears as a forced restriction of output, it is hoped that it will prove beneficial to producers by lowering the production to an anticipated lessened demand for zinc concentrates during May and June.

Platteville, Wis., April 27, 1929

Zinc Blende

	Per Ton
Blende, basis 60 per cent zinc	$42.75

Lead Ore

Lead, basis 80 per cent	$90.00

Shipments for the week: Blende, 787 tons; lead, none. Shipments for the year: Blende, 11,421; lead, 640 tons. Shipments for the week to separating plants, 1,225 tons blende.

Platteville, Wis. May 4, 1929

Zinc Blende

	Per Ton
Blende, basis 60 per cent zinc	$46.75

Lead Ore

Lead, basis 80 per cent	$90.00

Shipments for the week: Blende, 693 tons; lead, none. Shipments for the year: Blende, 12,114; lead, 640 tons. Shipments for the week to separating plants, 1,188 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the May 4 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Market firm.

Antimony Oxide, Calcium Molybdate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the May 4 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $33@$34 f.o.b. furnace.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Nickel Silver, and Yellow (Muntz) Metal are unchanged from prices in the May 4 issue.

Rolled Metals

Copper, Lead, Zinc, Monel Metal, and Nickel Sheets are unchanged from prices in the May 4 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of May 4.

Iron, Steel and Coke

IRON—Per gross ton, Valley furnaces, Bessemer, $18.50@$19; basic, $18.50; No. 2 foundry, $18.50.

STEEL—Base prices per gross ton Pittsburgh, billets and slabs, $35@$36; plates, structural shapes, and soft steel bars, per 100 lb., $1.95.

COKE—Per gross ton, Connellsville furnace, $2.75@$2.85. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky (Connellsville basis) $6.50; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended May 4, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	146⅛	140½	143⅜	Mr.29,My.20 Q	1.75
Anaconda Cop., new	New York	121½	117	119⅜		
Andes Copper	New York	58⅜	52½	56⅛	Mr.29, My.6 Q	0.75
Arizona Com	Boston	4	3⅛	3⅞	Ja. 16, Ja. 31 S.A.	0.25
Calumet & Aris	New York	137	132½	132⅝	My.31, Je.17 Q	2.50
Calumet & Hecla	Boston	47½	45⅜	46	My.31, Je.29 Q	1.00
Cerro de Pasco	New York	104⅛	101	103½	Ap.11, My. 1 Q	1.50
Chile Copper	New York	104	102½	104	Je. 1, Je.28 Q	0.87½
Con. Coppermines	N. Y. Curb	13⅜	12½	13⅛		
Copper Range	Boston	26	25	25⅜	Mr.15, Ap.15 Q	0.50
East Butte	Boston	3½	3⅜	3⅜	Dec., 1919	0.50
Granby Con	New York	86½	82⅜	84	Ap.12, My.1 Q	1.75
Greene Cananea	New York	168⅜	160	166	Mr. 7, Ap. 1 Q	2.00
Howe Sound	New York	73½	70⅜	71½	Mr. 30, Ap. 15 Q	1.00
Hudson Bay	N. Y. Curb	18⅜	18	18⅛		
Inspiration	New York	51⅜	48½	49⅜	Mr.14, Ap. 1 Q	1.00
Isle Royale	Boston	26½	24	25⅜	My. 31, Je.29	0.50
Kennecott	New York	96½	88½	95⅛	No. 30, Ja. 2 Q	2.00
Magma Copper	New York	74⅜	70	72⅛	Mr.30, Ap.16 Q	1.25
Mason Valley	N. Y. Curb	1½	1⅜	1½		
Miami Copper	New York	47	44	44⅛	My1, My15 Q	1.00
Mohawk	Boston	60⅛	56⅜	59	Ap. 30, Je. 1 Q	1.50
Mother Lode	New York	4	3⅜	3⅜	De.14, De.31 SA	0.20
Nevada Con	New York	58⅛	46⅛	52⅛	Mr.15, Mr.30 Q	0.75
New Cornelia	N. Y. Curb	48	46	46⅛	Fe. 1, Fe. 18 Q	0.50
Noranda	N. Y. Curb	54⅜	50⅜	53⅜		
Ohio Copper	N. Y. Curb	2⅛	2⅛	2⅛	Sept., 1926	0.03
Old Dominion	Boston	13½	12½	12⅝	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	80½	75⅛	80½		
Quincy	Boston	40½	37½	38	March, 1920	1.00
Roan Antelope	N. Y. Curb	46⅛	43	45⅛		
St. Mary's M. L.	Boston	36⅛	35⅛	36⅛	Fe.25, Mr.12	2.00
Seneca Copper	New York	7	6⅛	6⅞		
Shattuck Denn	N. Y. Curb	21	19⅜	20⅛		
Sherritt-Gordon	Toronto	8.50	8.25	8.40		
Tenn. C. & C.	New York	20⅞	18⅛	19⅛	Fe.28, Mr.15 Q	0.25
United Verde Ex	N. Y. Curb	18⅛	17⅛	17⅛	Ap. 4, My. 1 Q	1.00
Utah Copper	New York	325	320	325	Mr. 15, Mr. 30 Q	3.00
Waite-Ack.-Mont	Toronto	3.85	3.50	3.85		
Walker Mining	Salt Lake	3.95	3.75	3.85		
Wenden Copper	N. Y. Curb	1⅛	1⅛	1⅛		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	3	2⅞	2⅞		
Amer. Z. L. & S.	New York	36⅛	32	35	May, 1917	1.00
A. Z. L. & S., pfd.	New York	98⅜	96	98⅛	Nov., 1920	1.50
Bingham Mines	Boston	54⅜	54	54	Mr.15, Ap.5	0.50
Bunker Hill & S.	N. Y. Curb	148	148	148	Ap.25, My.6 X	0.75
Butte Cop. & Zn.	New York	7⅜	7⅛	7⅛		
Butte Cop. Con.	Boston Curb	*57	*50	*52		
Butte & Sup.	New York	8⅛	8	8	Mr. 15, Mr. 30 Q	0.50
Callahan Zn-Ld.	New York	2⅜	2⅛	2⅛	Dec., 1920	0.50
Chief Consol.	Salt Lake	3.60	3.55	3.55	Fe. 1, 1928 K	0.10
Consol. Ld. & Zn. "A"	St. Louis	....	....	15	Ap.5, Ap.10	0.25
Constitution	Spokane	*33	*30	*32½		
Dayrock	Spokane	2.55	2.47	2.47	Mr.23, Mr.30	0.03
Dickens Consol.	Spokane	*8	*4	*6½		
Eagle-Picher	Cincinnati	19	18	18	Mr.31, Ap.15 Q	0.20
Eagle-Pich., pfd.	Cincinnati	....	....	102	Jan. 15 Q	1.50
Erupcion	Boston Curb	*15	*10	*10	Ja. 1, 1928 Q	0.07½
Eureka Bullion	Salt Lake	*98	*95	*96		
Eureka Lilly	Salt Lake	....	....	1.42½		
Eureka Standard	Salt Lake	....	....	5.00		
Evans-Wallower	N. Y. Curb	16⅛	15⅜	15⅜		
Evans-Wal., pfd.	N. Y. Curb	....	....	84½	Mr.20, Ap.1 Q	1.75
Federal M. & S.	New York	....	....	245	Je., 1927	10.00
Fed. M. & S., pfd.	New York	99½	99⅛	99¼	Fe. 21, Mr. 15 Q	1.75
Gladstone	Spokane	*12½	*9½	*12½		
Golconda	Spokane	1.88	1.50	1.59	Mr.20, Ap.1 Q	0.02
Grandview	Spokane	*49½	*44½	*47		
Hecla Mining	N. Y. Curb	19⅛	17½	18⅛	My.15, Je.15 Q	0.25
Highland-Surprise	Spokane	*16	*10	*13		
Jack Waite	Spokane	*12½	*11	*11		
Kootenay Florence	Spokane	*15½	*15	*15		
Lucky Jim	Spokane	*17	*15	*15		
Lucky Tiger-C.	Kansas City	†5.50	†5.25	....	De.4, De.20 MX	0.12
Mexican Premier	Spokane	1.68	1.63	1.67½		
National Lead	New York	152½	145	150	Mr. 15, Mr. 31 Q	1.25
Natl. Lead, pfd. A	New York	140	140	140	Mr. 1, Mr. 15 Q	1.75
Natl. Lead, pfd. B	New York	118	118	118	Ap. 19, My 1 Q	1.50
N. J. Zinc	N. Y. Curb	....	....	330	Ap.20, My. 10 Q	2.00
N. J. Zinc, new	N. Y. Curb	84	83½	83½		
New Quincy	Salt Lake	2.52½	2.37½	2.42½	My.15, My.27 Q	0.10
Noble Five	Spokane	*67	*60	*62		
North Lily	Salt Lake	8.50	8.50	8.50	Jan. 20 Q	0.25
Park Bingham	Salt Lake	*9½	*8	*9		
Park Utah	New York	10½	9½	9⅞	Mr. 19, Ap. 10 Q	0.20
Pend Oreille	Spokane	6.50	5.75	5.75		
Rico Argentine	Salt Lake	*42	*40	*40	No. 30, De. 15 Q	0.03
Ruth-Hope	Spokane	*41	*35	*35		
St. Joseph Lead	New York	74⅜	67	70⅜	Ju. 8, Ju.20 QX	0.75
Sherman Lead	Spokane	*37½	*36	*37		
Silver King Con.	Salt Lake	13.87½	13.50	13.50	Mr. 20, Ap. 1 Q,	0.25
Silversmith	Spokane	*14½	*13	*14½	Oct., 1926 Q	0.02
Sunshine Mining	Spokane	1.85	1.80	1.85	De. 20, BM	0.02
Tamarack-Custer	Spokane	*71	*65	*68½	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.87½	13.75	13.75	De. 23, Ja. 23 X	0.20
Tonopah Belmont	N. Y. Curb	*80	*62½	*62½	Oct., 1925	0.05
Treadwell-Yukon	Toronto	13.00	13.00	13.00		
United Zinc Smg.	N. Y. Curb	1	1	1		
Utah Apex	Boston	4⅛	4⅛	4⅛	May 15, June 1	0.25
Utah Met. & Tun.	Boston	1⅜	1⅛	1⅜	Dec., 1917	0.30
Whitewater	Spokane	1.00	*80	*95		
Yellow Pine	Los Angeles	....	....	*16	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	7⅛	6⅞	6⅞		
Barry-Hollinger	Toronto	*34	*31½	*31½		
Central Manitoba	Toronto	*59	*48	*50		
Coniaurum	Toronto	....	....	*45		
Cresson Consol.	N. Y. Curb	*81½	*75	*75	Mr.30, Ap.10 Q	0.02
Dome Mines	New York	10⅛	10	10	Mr.30, Ap..20 Q	0.25
Golden Cycle	Col. Springs	†1.64	†1.61	....	Fe.15, Mr.1	0.04
Gold Hill	Toronto	*4	*3	*3½		
Hollinger	Toronto	7.60	7.25	7.25	My.3, My.20 M	0.05
Homestake	New York	76½	76	76½	Ap.20, Ap.25 M	0.50
Kirkland Lake	Toronto.	1.12	1.02	1.03		
Lake Shore	Toronto	27.00	26.50	26.80	Mr.1, Mr.15 Q	0.20
McIntyre-Porc	New York	18	18	18	My.1, Je.1 Q	0.25
Portland	Colo.Springs	†*18	†*12	....	April, 1927	0.02
Rand Mines	New York	....	....	35	Fe. 21,'28 Am.Sh.	1.52
Siscoe	Toronto	*78	*70	*78		
Sylvanite	Toronto	1.80	1.60	1.60		
Teck-Hughes	Toronto	9.50	9.25	9.40	Ap. 7,My 1, O	0.15
Tom Reed	Los Angeles	*30	*15	*15	Dec., 1926	0.02
Unity Gold	N. Y. Curb	2	1⅞	1⅞		
Vipond Consol	Toronto	1.10	1.01	1.07	April, 1927	0.03
Wright-Hargreaves	Toronto	1.87	1.75	1.76	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb	....	....	35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	17⅛	16	17		
Castle-Trethewey	Toronto	*35	*34	*35		
Consol. Cortez	N. Y. Curb	....	....	*18		
Dolores Esperanza	N. Y. Curb	1	1	1	July, 1923	0.05
Keeley	Toronto	*65	*50	*56	Mr.15, 1928	0.04
Mining Corp.	Toronto	4.45	4.20	4.25	De.14,De.31 SA	0.15
Montana-Idaho	Spokane	*11⅛	*11	*11⅛		
N. Y. & Hond. Ros.	N. Y. Curb	....	....	18	Ap.17,Ap.27 QX	0.05
Nipissing	N. Y. Curb	3⅛	3	3⅛	Mr.30,Ap.20 Q	0.07½
Premier Gold	N. Y. Curb	2⅛	1⅞	2	Mr.14, Ap.4	0.06
Tonopah Exten	N. Y. Curb	....	....	*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	3⅛	3⅛	3⅛	Ap. 7, Ap. 20	0.07½
United Eastern	N. Y. Curb	*81	*56½	*75		
Yukon Gold	N. Y. Curb	*66	*66	*66	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	114⅛	108⅛	111½	Jl.19, Au.15 Q	1.00
Beth. Steel, pfd, 7%.	New York	119⅛	117½	118	Je.1, Jl.1 Q	1.75
Cleveland-Cliffs	Cleveland	260	230	240	Ap.15, Ap.25 Q	1.00
Colo. Fuel & Iron	New York	71	65½	67⅛		
Colorado F. & I., pfd.	New York	....	....	133	My.10,My.25, Q	2.00
Great Northern Iron.	New York	30½	29⅛	30	Dec.15, K	2.00
Inland Steel	New York	93	91½	92	My.15, Jn. 1, Q	0.87½
Republic I. & S.	New York	100⅛	96	98⅞	My. 11, Je. 1, Q	1.00
Republic I. & S., pfd.	New York	112	111	112	Je.12, Jl. 1, Q	1.75
Sloss-Sheffield S. & I.	New York	111	109	110	Mr. 11, Mr.20, Q	1.50
Sloss-Sheff. S. & I., pfd.	New York	108	108	108	Mr.20, Ap.1, Q	1.75
U. S. Steel, new	New York	186	181	184⅛		
U. S. Steel	New York	182⅛	181½	182⅛	My. 31, Jn. 29, Q	1.75
U. S. Steel, pfd.	New York	144	142½	142⅛	My. 4,My 29, Q	1.75
Virginia I. C. & C.	New York	....	....	23	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	....	....	47½	Jl.16, 1928	SA2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	274⅛	214	270		
Alum.Co.of Amer., pf.	N. Y. Curb	107	106⅛	106⅛	Mr.15, Ap.1, Q	1.50
American Metal	New York	61⅛	58	59	My.9, Je. 1 Q	0.75
Amer. Metal, pfd., 6%	New York	117	115⅛	117	My.21, Je.1, Q	1.50
Amer. Sm. & Ref.	New York	112⅛	103⅜	109	Ap.12,My 1,Q	1.00
Amer. & Sm. Ref., pfd.	New York	136½	135	136	My. 3, Ju. 1 Q	1.75
Ang. Ch. Nitrate	N. Y. Curb	40	37⅛	39		
Asbestos Corp.	Montreal	13	12	13	Jan. 1926	1.50
Asbestos Corp., pfd.	Montreal	38	36	38	De. 31, Ja. 15 Q	1.75
Consol. M. & S.	Montreal	425	410	425	De.31,Ja.15,SAX	6.25
De Beers Consol.	New York	23	23	23	Ja. 19, Ja.26,	0.48
Federated Metals	N. Y. Curb	35	32½	34⅛	Mr.27, Ap.5 Q	0.75
Freeport Texas	New York	45⅛	44	45½	Ap. 5, My. 1 Q	1.00
Int. Nickel Can.	New York	54⅛	47⅛	53⅛	Mr.16, Mr.30 Q	0.20
Int. Nickel, pfd.	New York	121	121	121	Ap.2,My.1No.1Q	1.75
Newmont	N. Y. Curb	221⅛	208	215⅛	Mr.30, Ap.15 Q	1.00
Patiño M. & E.	New York	40½	38⅛	38⅛	Ap. 20, Ap. 30	4s
So. America G. & P.	N. Y. Curb	2⅛	2⅛	2⅛		
Texas Gulf Sulphur	New York	84	80½	81⅛	Mr.4, Mr.15 Q	1.00
U. S. Sm. R. & M.	New York	62⅛	58⅛	62	Ap. 4, Ap. 15 Q	0.87½
U. S. Sm. R. & M., pfd.	New York	54½	52½	53⅛	Ap. 4, Ap. 15 Q	0.87½
Vanadium Corp.	New York	98⅛	92	95	Fe.1, Fe. 15 Q	0.75

Toronto Standard Stock Exchange, Toronto, courtesy Arthur E. Moysey & Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. R, Irregular. I, Initial. R, Resumprion. X, Extra. The first data given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED APRIL 23, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	20/—	20/—	20/—		
Alaska Treadwell (25)	60/—	60/—	60/—	Nov., 1926	4 p.c.(d)
Aramayo Mines (25 frs.)	67/6	65/7½	66/3	Feb. 1929	5 p.c.(†)
Burma Corp (10 rupees)	17/6	17/—	17/4½	Feb., 1929	7 annas*
Bwana M'Kubwa (5s)	19/6	18/6	18/9		
Camp Bird (2s)	2/6	2/4½	2/6	April, 1928	16⅔ p.c.
El Oro (£1)	4/9	4/6	4/9	Nov., 1924	2½ p.c.*
Frontino & Bolivia (£)	9/—	9/—	9/—	Jan., 1929	3½ p.c.
International Nickel of Canada (Quoted in dollars with a fixed rate of $5 to the £1) (no par value)	$52½	$48⅛	$52½	Mar., 1929	20(d)
Mexican Corpn. (£1)	15/4½	13/3	15/—		
Mexican Mines of El Oro (£1)	6/—	4/4½	5/—	Dec., 1926	3½ p.c.*
Mount Isa (£)	47/3	46/3	46/10½		
N'Changa Copper Mining. (£1)	78/9	73/9	76/3		
Oroville Dredging (4s)	2/6	2/4½	2/6	Nov., 1928	31½ p.c.
Rhodesian Congo Border (£1)	146/10½	128/9	132/6		
St. John del Rey (£1)	18/9	15/3	18/3	Apr., 1929	7½ p.c.
San Francisco Mines (10s)	36/3	35/—	36/—	Jan., 1929	25 p.c.
Santa Gertrudis (£1)	10/4½	9/7½	10/—	Jan, 1929	7½ p.c.
Selukwe (2s. 6d.)	6/10½	6/—	6/9	April, 1917	6¼ p.c.
S. Amer. Copper (2s.)	2/10½	2/6	2/9	Nov. 1917	75 p.c.
Tanganyika (£1)	64/9	58/9	62/6	July, 1928	5 p.c.
Union Miniere de Haut-Katanga (Brussels)	12,025	11,675	11,975	July, 1928	182.60 fr.(6)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. ( ) U. S. Doll rs.